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**Engaging Cooperative Farmers in Agricultural Intensification:
Case Studies on Honey, Dairy and Linseed Value Chains in Ethiopia**

Clarietta Chagwiza

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Engaging Cooperative Farmers in Agricultural Intensification: Case Studies on Honey, Dairy and Linseed Value Chains in Ethiopia

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**Engaging Cooperative Farmers in Agricultural Intensification:
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Doctoral Thesis

to obtain the degree of doctor from

Radboud University Nijmegen

on the authority of the Rector Magnificus prof. dr. S.C.J.J. Kortmann,

according to the decision of the Council of Deans

to be defended in public on Wednesday, June 11, 2014

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Table of Contents

List of tables.....	10
List of figures.....	11
Abbreviations and acronyms	12
Dedication	13
Acknowledgements	15
CHAPTER 1. Introduction	19
1.1 Problem statement	19
1.2 The structure of honey, dairy and linseed value chains	23
1.3 Research questions	27
1.4 Relevance of the study	30
1.5 Data and Methods.....	33
1.6 Outline of the thesis.....	36
CHAPTER 2. Collective Entrepreneurship and Rural Development: Comparing Two Types of Producers' Organizations in the Ethiopian Honey Sector	41
Abstract	41
2.1 Introduction	42
2.2 Collective entrepreneurship.....	43
2.3 The Ethiopian honey sector.....	46
2.4 Methodology	48
2.5 Empirical results.....	51
2.6 Discussion	62
2.7 Conclusions	65

CHAPTER 3. Determinants of performance among small-scale dairy producers in Ethiopia: trade-offs between productivity and quality	67
Abstract	67
3.1 Introduction	68
3.2 Factors Influencing Dairy Production Performance.....	70
3.3 Setting and methods	74
3.4 Empirical results.....	78
3.5 Discussion and policy implications.....	89
 CHAPTER 4. Cooperative Membership and Dairy Performance among Smallholders in Ethiopia.....	95
Abstract	95
4.1 Introduction	96
4.2 Determinants and impacts of cooperative membership	98
4.3 Methodology	100
4.4 Empirical Results	104
4.5 Discussion and policy implications.....	109
 CHAPTER 5. Knowledge Systems and Value Chain Integration: Case of Linseed Production in Ethiopia	115
5.1. Introduction	116
5.2 Conceptual framework	119
5.3 Methodology	123
5.4 Empirical results.....	124
5.5 Discussion and policy implications.....	129
 CHAPTER 6. Discussion and conclusions.....	133
6.1 Introduction	133
6.2 Results	134
6.3 Contributions to scientific discussion/ theoretical advances.....	137
6.4 Policy implications.....	141

6.5 Further research.....	143
References	145
Appendices (to Chapter 5).....	160
Summary.....	163
Samenvatting (Summary in Dutch).....	169
About the author	175

List of tables

Table 1.1 Production and marketing characteristics of the 3 value chains	25
Table 1.2 Descriptive information on the selected value chains.....	34
Table 2.1 Average Yield Potential per each hive type	48
Table 2.2 Number of members in the producers' groups that participated in the study	50
Table 2.4 Summary of independent-samples t-test results.....	53
Table 2.5 Summary of Pearson χ^2 test results	54
Table 2.6 Marketing constraints as reported by the beekeepers	59
Table 2.7 Variables and their expected signs.....	60
Table 2.8 Factors influencing income from honey sales (OLS regression analysis)	61
Table 3.1 Total population and proportion of samples selected	76
Table 3.3 Feed types utilized by respondents in the study area	80
Table 3.4 Comparisons between dairy farmers who are members and non-members of cooperatives	82
Table 3.5 Factors affecting milk production	84
Table 3.6 Factors affecting milk productivity	85
Table 3.7 Factors affecting milk quality components (OLS).....	87
Table 4.1 Descriptive statistics for members and non-members	105
Table 4.2 Probit model estimates for the probability of cooperative membership	107
Table 4.3 Impact of cooperative membership on dairy farmers	108
Table 5.1 Descriptive data characterizing respondents.....	125
Table 5.2 Descriptive statistics on categorical variables.....	126

List of figures

Figure 1.1 Conceptual framework of the study.....	29
Figure 1.2 Summary of thesis outline	39
Figure 2.1 Operationalization of collective entrepreneurship.....	46
Figure 2.2 Map showing the study area Masha-Sheka Zone (Abbute 2003).....	49
Figure 2.3 Price variation among buyers across years.....	56
Figure 2.4 Honey sales by PLCs	58
Figure 2.5 Honey sales by cooperatives.....	58
Figure 3.1 Analytical framework: Research model	74
Figure 3.2 The milk value chain in Ethiopia.....	75
Figure 4.1: Map showing the study area	101
Figure 5.1: Conceptual framework on knowledge bases	122
Figure 6.1 Moving towards “balanced growth” intensification	140

Abbreviations and acronyms

AKIS	Agricultural Knowledge and Information Systems
ATT	Average Treatment Effect of the Treated
CE	Collective Entrepreneurship
CIA	Conditional Independence Assumptions
ETB	Ethiopian Birr (currency)
EU	European Union
FFS	Farmer Field School programs
GAP	Good Agricultural Practices
GOs	Governmental Organizations
NGOs	Non-Governmental Organizations
NN	Nearest Neighbour
PLCs	Private Limited Companies
PSM	Propensity Scores Matching
SDCU	Selale Dairy Cooperative Union
SNF	Solids-Non-Fat
SNV	Netherlands Development Organization
USA	United States of America
USD	United States Dollar
VIF	Variance Inflator Factor

Dedication

To my mom, Mellaniah Chagwiza, who passed away the very year I started my doctorate.

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It just seems like yesterday when I started my doctorate and now it is so fulfilling to realize that the *work* is finally done. Truth be told, the journey has not been an easy one. There were so many obstacles on the way that could make me really think twice, but surrounded by positive thinkers and encouraging people I could see the light at the end of the tunnel. By writing this section of my thesis, I am filled with so much joy that comes from deep within. All thanks to Ruerd Ruben for believing in me and giving me a chance to work on his project. Infact, I owe a deep gratitude to a number of individuals who made this work a success, which is the reason why I feel very much obliged to write this part of the thesis.

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CHAPTER 1. Introduction

1.1 Problem statement

Farmers in developing countries like Ethiopia are under intense pressure for enhancing their market orientation due to the increasing demand for agricultural commodities on domestic markets and abroad. Market requirements also become stricter due to quality criteria imposed by processors and consumers. The rise in global food prices observed since 2008 represents an opportunity to unleash the agricultural potential of Ethiopia (Francesconi and Ruben, 2012). To take advantage of this opportunity, low agricultural productivity in Sub-Saharan Africa (SSA) still continues to be a major development challenge to African policy makers and international development community (Abebaw and Haile, 2013). Consequently, individual smallholder farmers' face many constraints that impede them from taking advantage of emerging market opportunities (Fischer and Qaim, 2012). They face major difficulties as a result of lack of production and marketing knowledge, shortage of inputs and capital, etc that can impede their participation in the value chains. In a similar vein, Lopez (1998) and Bernard et al. (2010) highlight that poor farm households do not participate in certain markets due to the existence of high transaction costs associated with geographic isolation, poor infrastructure and lack of market integration. For engaging in value chain¹ relationships, farmers need to be organized in such a way that can guarantee coordination and integration with crucial stakeholders such as traders, processors and exporters. There is an urgent need to focus on collective action that can enhance agricultural development. Nguyen and Cheng (1997) points out that agricultural development is of key importance in any development strategy. This is even more the case in developing countries where majority of the population depends on agriculture as their main source of living.

The government of Ethiopia has realized the importance of cooperatives as vehicle to improve commercialization and for poverty reduction amongst the resource-poor farmers (Getnet and

¹ Value chain development refers to the relationships between the agents (input suppliers, farmers, processors, exporters) along the value chain engaging in market-focused collaborations to ensure that quality products are channeled from the production stage to the point of consumption.

Anullo, 2012). This makes sense since as Abebaw and Haile (2013) state that over 95% of the agricultural output originates from smallholder farmers who need efficient support to boost productivity as a way out of poverty. Intensification is therefore a key to agricultural development where special attention is placed on, for instance, high-yielding seeds and the use of improved inputs such as fertilizer, agrochemicals, etc. Bernard et al. (2008) provide evidence that donors and governments have revived their interest in collective action mechanisms, including cooperatives, to overcome smallholders' marketing constraints as a complementary device to enhance intensification. Currently, cooperatives are considered as a model to promote agricultural development and commercializing of smallholder producers and to enhance community rural development in Ethiopia (Getnet and Anullo, 2012; Bernard et al. 2008).

No consensus has been reached, however, on the appropriate pathways for intensification. Shriar (2000) defined intensification as “increasing yield and production over time through increases in inputs of any form or another on a per unit area/output basis”. In this thesis, we adopt the definition by Poulton et al. (2006) where agricultural intensification involves both technical change and access to inputs, seasonal finance and marketing systems to increase farm production and deliver it to consumers at a competitive price. Our definition thus encompasses reliance on (1) improved technologies and (2) farmer organizations as ways to increase productivity (yield) and prices simultaneously. By encouraging the application of modern inputs and farming techniques, diversification out of low-yielding subsistence crops, and specialization into more tradable crops, commercialization can increase farming incomes, enhance their purchasing power, and reduce vulnerability among smallholders (Bernard et al. 2010). Organizational innovation can thus be considered as a complementary strategy to enhance technological change.

There is some scattered evidence showing that cooperatives can indeed facilitate the intensification of agricultural production systems in developing countries, by means of facilitating access to inputs, knowledge transfers and the adoption of more productive technologies (Francesconi, 2009; Aneja, 1993; Getnet and Anullo, 2012; Odoemenem and Obinne, 2010). Agricultural cooperatives can be cost-saving and risk-sharing devices for farmers in uncertain agri-commodity markets (Francesconi, 2009). For instance, in Ethiopia the dairy

sector deals with a perishable product where the demand fluctuation is high due to pro-longed fasting periods by the Orthodox Christians. By pooling input supply purchases, output sales, and handling and selling expenses, cooperatives may operate more efficiently at lower costs per unit of output than farmers can individually (Mather and Preston, 1990). Cooperatives could also provide farmers with the mechanisms to avoid destructive competition among each other and to increase their collective bargaining power vis-à-vis retailers (UN, 2009).

However, just like any other business enterprise, cooperatives have their own flaws that can seriously destroy the whole purpose of cooperation. The Ethiopian cooperatives, for example, have passed through many phases: starting from the Imperial era (1930-1974), then followed by Derg period (1974-1991) where the Derg regime tended to abuse cooperatives (Kodama, 2007). This culminated in a period of corruption which saw many cooperatives collapsing, until 1994 when the government took a decisive stance to promote collective action as a way to improve smallholder participation in markets.

A number of key challenges associated with the Ethiopian cooperatives in particular have been highlighted in the literature. These have much to do with the internal structure and the lack of cohesion in many cooperatives (Getnet and Anullo, 2012). Other challenges include the lack of capacity to provide competent managerial services, limited participation of members in decision-making and controlling activities (because of scarce capacities and skills) and lack of finance, basic infrastructure and market information that hinder the establishment of improved linkages of agricultural cooperatives with input and output markets. In general, cooperatives have also been viewed as State instrumentalities or parastatals, being less concerned with the genuine needs of their members (UN, 2009). Ruben and Heras (2012) highlight that agricultural cooperatives established in developing countries frequently face performance problems since many of them are established on the basis of political criteria by external agents, as a part of public investment strategies or rural development programs launched by international agencies, rather than by farmers themselves. Furthermore, the cooperatives in Ethiopia face low participation rates (Bernard et al. 2008). The UN (2009) report pinpoints to one particular factor slowing the

participation of small farmers in marketing cooperatives: the distrust arising from the history of cooperatives established by external state intervention.

However, while some advocate for cooperatives, there is limited empirical evidence that assesses the real impact of cooperatives on production and marketing performance. Many authors evaluated the impact of cooperatives from the production and farming system management (quality and productivity) point of view (Francesconi and Ruben, 2012; Francesconi, 2009). In this study, in addition to production performance, we aim to evaluate the impact of cooperative membership also from the dynamic marketing point of view, focusing on the effects on prices and commercialization, product upgrading and technology adoption. The issue of technology adoption is important because of its relation to agricultural intensification which has been advocated as an answer to address low productivity problems among farmers (Tangka et al. 1999). In relation to intensification, Francesconi (2009) provides evidence of trade-offs between quality and quantity in production that arises from the use of high yielding technologies promoted by dairy cooperatives.²

In order to increase the economic benefits that farmers can derive from the improving market opportunities, it might be desirable for farmers to be organized in collective groups. This can enable them to achieve economies of scale, bargaining power and capacity to invest in more advanced stages of the value chain, including storage, processing, marketing and distribution. However, being in an organized group *per se* is not enough to achieve the aforementioned beneficial advancements. There are a number of collective action issues that have to be looked at in order to ascertain the conditions under which a successful operation of the collective group can be attained. There are major institutional and structural differences between and within groups that may cause constraints in the way that cooperatives react to opportunities and innovations. These differences range from group size, age of the organization, organization type, etc, that can promote or impede collective action. Scarce attention has been paid in the literature to analyze how internal organization among farmers influences collective entrepreneurship and

² Another limitation of intensification has to do with environmental trade-offs where, for instance, increased reliance on chemicals may have negative consequences for the environment and raises the question of both economic and environmental sustainability (Carswell, 1997). However, environment issues are not the focus in this thesis.

rural development in Ethiopia. Hence, there is a need to look at these institutional and structural differences in order to assess how they influence collective action outcomes, such as household income and welfare.

Knowledge on production and marketing of agricultural products has also been reported as important to promote agricultural development through increased productivity, quality upgrading and technology adoption. Knowledge can improve the production skills and marketing strategies of farmers, ensuring that they are in a better position to reap economic benefits from their transactions. Farmers can acquire knowledge through various means ranging from formal education, farming experience, training and tacit knowledge (obtained for instance through repeated interaction with buyers). Different authors (e.g. Feder et al. 2004; Hasnah et al. 2004; Weir, 1999; Djomo and Sikod, 2012) have assessed the influence of different knowledge sources on productivity, showing mixed evidence on the direction of impact. In many instances, tacit knowledge derived from market interactions has often been overlooked. In this regard, Boateng (2006) already notes that the over-reliance on technical knowledge and the neglect of farmers' tacit knowledge in agricultural extension practice has long been identified as an impediment to increased agricultural productivity.

In this thesis we attempt to disentangle the process of agricultural intensification and the key factors that drive this process. More specifically, we examine different aspects that influence the process of intensification, including input use (which encompasses the use of improved agro technologies), knowledge and producer organizational features. Addressing these issues can provide important information required for facilitating farmers' engagement into value chains so as to improve their income as well as to fulfill the demands and quality requirements of consumers.

1.2 The structure of honey, dairy and linseed value chains

The study is based on case studies in three sectors in Ethiopia: honey, dairy and linseed. We provide a brief characterization of the main features of these sectors. We opted for a comparative work in these three different value chains to enable a problem-focused analysis around key

limiting factors. In the honey sector, small-scale producers are the most important producers in Ethiopia. The sector has a high market potential through market-focused collaboration and contracting relations with the other players downstream the value chain such as processors. Ethiopia currently exports honey to the international markets mainly USA, Japan and the EU. The key challenge is to identify optimal linkages with producers to enhance market-orientation and sales volumes. We analyze which marketing regimes are most favorable for this purpose.

Ethiopia holds a large potential for dairy development due to its large livestock population and the favorable climate throughout the country, which supports the use of improved, high-yielding animal breeds and offers a relatively disease-free environment for livestock development (Ahmed et al. 2004). The dairy sector is, however, under pressure due to the increased demand of milk and milk products. Despite the great potential, the sector faces low productivity and quality management problems. The sector is dominated by smallholder farmers that supply most of the milk and could take advantage of the increasing demand to improve their income and livelihoods. Dairy cooperatives show a favorable performance for increasing productivity, but tend to be less conducive for enhancing quality. We analyze how this trade-off can be overcome.

Lastly, linseed is one of the major types of export oilseeds (apart from sesame and Noug). Linseed is used both at the domestic market (as crude oil for cooking purposes) and in export markets (as an industrial input). The oilseeds sector is currently the second export product after coffee. However, just like in dairy, the sector faces low productivity problems due to unfavorable weather conditions and lack of technical skills in production (Muradian et al. 2012). We use this case study to illustrate the importance of different type of knowledge inputs for enhancing productivity. Apart from education and training, information derived from the market itself can become a major driver for agricultural intensification.

Table 1.1 presents a comparative overview of production and marketing characteristics of each of the three sectors.

Table 1.1 Production and marketing characteristics of the 3 value chains

	Honey (Semi-perishable commodity)	Dairy (Perishable commodity)	Linseed (Storable commodity)
Production	<ul style="list-style-type: none"> - Dominated by smallholder farmers - Characterized by low quality of honey (high moisture content) - Need of improved beehives to improve productivity and quality of honey extracted 	<ul style="list-style-type: none"> -Smallholders dominate the sector -Low productivity and poor quality management -Improved technologies to curb the demand for milk and milk products 	<ul style="list-style-type: none"> -Sector dominated by smallholders -Low productivity problems -Lack of technical skills in production
Marketing	<ul style="list-style-type: none"> - Cooperatives, private limited companies (PLCs) and traders are main marketing agents - Service to both the domestic and export market - Weak market linkages 	<ul style="list-style-type: none"> -Cooperatives are major marketing agents, other buyers include private traders or individuals -Service only to the domestic market -High transaction costs owing to the perishable nature of the product -High demand fluctuations 	<ul style="list-style-type: none"> -Cooperatives and private traders are the main marketing agents -Service to domestic and growing export market -Commercialization still traditional -Weak market linkages
Organization	<ul style="list-style-type: none"> -Quality upgrading can be easily attained in this value chain 	<ul style="list-style-type: none"> -Time matters since milk is highly perishable -Close coordination required to avoid spoilages and losses 	<ul style="list-style-type: none"> -With proper management it is feasible to achieve economies of scale

Source: Based on field surveys

Key bottlenecks in the three value chains

Each of the three sectors face their particular key bottlenecks related to production and marketing. Nevertheless, low productivity is a common challenge in all the three sectors. In this sub-section, we highlight these key constraints for each sector. In other words, we seek to justify why we focus on a specific issue in one sector and not the other. Assessing the key bottlenecks to sector growth and improvements in the economic prospects of farmers is essential to identify the necessary interventions for overcoming these challenges. In this thesis, we looked at commodities of a rather different nature, perishable (dairy), semi-perishable (honey) and storable (linseed). The type of commodity and the key intensification bottlenecks faced influence the type of organization of the value chain. Hence, the three value chains differ in their degree of the importance of collective action and the level of market integration. The honey sector is characterized by weak market linkages and low productivity. Nevertheless, quality upgrading can be easily achieved in this value chain. The dairy sector is characterized by poor quality management and low productivity as well. In this value chain, time management is an important factor to avoid spoilages and losses. In the linseed sector, the farmers lack technical skills of production and often encounter low productivity. However, with proper management and adequate extension services, economies of scale can be easily reached since linseed does not require many inputs and is a labour-extensive crop.

The honey sector, particularly in the study area Masha, is endowed with rich forests which enable the production of “forest” and organic honey that cannot be found elsewhere in Ethiopia. This kind of honey has a great potential for serving the niche in the export market. However, for smallholders (who dominates the sector) to gain access to such markets and accrue economic benefits, they need to engage into high market-focused collaborations linking up with well-established processors along the value chain. As outlined by Fischer and Qaim (2012), scale is a key element for improving farmers’ access to output markets. Nevertheless, the manner in which the farmers are organized to reach scale clearly matters. There are different modalities for reaching scale and linking up with traders and processors. The honey sector analysis permits us to analyze how collective entrepreneurship may provide varied incentives for adopting improved beehive technologies and enhancing yields and income.

The issue of quality is most important in the dairy sector given the perishable nature of the product. Milk needs to be transported quickly and efficiently to the chilling facilities to reduce spoilages and losses. Managing quality of perishable products like dairy is highly complex, hence it requires close coordination of production and marketing activities to overcome losses. Time is crucial and we look at this issue focusing on cooperatives as possible and effective marketing agents that can help in organizing farmers and rendering services that reduce quality losses and at the same time facilitate intensification (and hence productivity increase) through use of better feeding and breeding technologies.

In linseed production, in addition to low productivity, lack of technical skills was identified as one of the major bottlenecks. As Belayneh and Alemayehu (1988) assert, management practices are more critical in linseed production as yield is mostly affected by insufficient weed control and inadequate sowing dates. Farmers need to be equipped with these skills and knowledge as a pathway for improving productivity. Since most of this information is time- and location-specific, education and formal training have little to offer and tacit knowledge is far more critical. Information exchange and cooperation with other farmers and with traders/processor from the supply chain might be optimal devices for reaching scale and adaptive management.

1.3 Research questions

While dealing with different types of commodities (perishable, semi-perishable and storable products) and value chain configurations in Ethiopia, we aim to address common issues related to agricultural intensification that are crucial for enabling producers to improve production, product quality, yields and margins through their engagement into value chains and the linkages to prospective market outlets that offer higher prices for their commodities. These strategies range from improved technical knowledge on how to improve production systems through different information dissemination methods, incentives for strengthening the performance of producer organizations that the farmers join, or better management regimes that enable farmers to use advanced technologies that improve product performance; all having implications for the economic benefits of farmers.

The overarching research question for this thesis is therefore defined as: *how do cooperative farmers in Ethiopia engage into processes of agricultural intensification and value chain integration, and what are the main drivers and the likely outcomes of this process?*

The specific research questions addressed in different parts of the thesis are:

1. How does the internal organization of farmer cooperatives affect collective entrepreneurship and income generation (case of honey producers)?
2. What are the factors that determine yields and quality performance among smallholder (case of dairy producers in Ethiopia)?
3. What are the individual factors that influence cooperative membership among farmers and what are the impacts of cooperative membership on technology adoption and market exchange (case of dairy cooperatives)?
4. How do knowledge systems and their interactions affect farmers' productivity and the way they are integrated into the market (case of linseed cooperatives)?

All these research questions revolve around the issues of market linkages and value chain integration for improving production and quality management through agricultural intensification where factors such as input use, knowledge systems and organizational type play a crucial albeit distinctive role for improving the economic benefits to producers and to promote rural development in Ethiopia. Hence, the particular issues discussed in this thesis are intimately interrelated. Figure 1.1 presents the conceptual framework for the research where we attempt to outline the important issues addressed in this thesis.

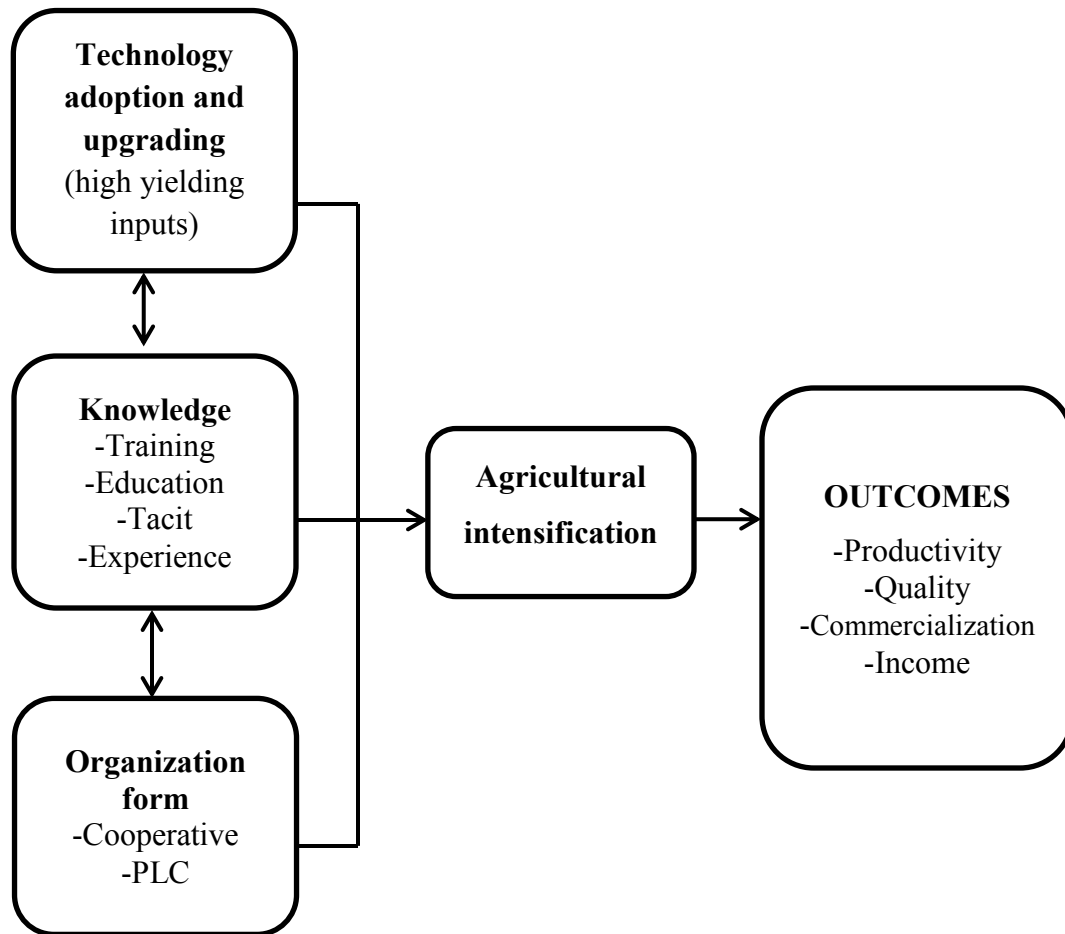


Figure 1.1 Conceptual framework of the study

As Figure 1 depicts, agricultural intensification is a complex process which involves different classes of driving forces that influence its dynamics. Main factors that could induce increased use of productivity-enhancing and quality-improving inputs (improved technologies like beehives, better breeds and dairy feeding, and linseed weeding and sowing) are related incentives, like access to appropriate knowledge, availability of inputs at acceptable prices, and prospects for realizing net profits. Another important incentive could be provided by the way that producer organizations are structured. Cooperatives can favor access to information and markets, mitigate risks and reduce uncertainties. The interactions between organizational innovation, market chain linkages and access to technologies ultimately determine whether the outcomes of agricultural intensification pay off to smallholder farmers.

1.4 Relevance of the study

Engaging farmers in value chains is frequently considered as an efficient way to align the production systems of farmers with specific requirements of the processors and consumers, in such a way that all the value chain players benefit, including the farmers. Francesconi (2009) suggests that participation in integrated supply chains has the potential to open up new market opportunities for rural smallholders. Moreover, there is growing global demand for food and farmers thus can shift towards a more intensive production system. In a similar vein, Staal et al. (2001) argue that intensification of agricultural production is occurring in order to increase food consumption and rural income levels in developing countries. Factors such as population growth and market access are usually highlighted as major driving forces for agricultural intensification (Pingali et al. 1987; Staal et al. 2001).

Agricultural intensification has mainly been discussed in the literature relative to its potential to overcome poverty-environment trade-offs (Pinstrup-Andersen and Pandya-Lorch, 1994; Pingali, 1990; and Pichón and Uquillas (1997). On one hand, Raut et al. (2010) argue that intensification has potential negative implications for soil degradation through soil erosion, nutrient depletion and soil acidification; and for climate change through emission of greenhouse gases. On the other hand, authors like Pinstrup-Andersen and Pandya-Lorch (1994) and Ruben et al. (2003) argue that the exploitation of natural resources leading to environmental degradation is frequently a result of poverty and lack of agricultural intensification. Hence, they suggest that making it easier for poor rural households to gain access to technologies is needed to guarantee that intensified agricultural production can have positive effects on the environment and on farm household welfare. Raut et al. (2010) point out that agricultural intensification can have positive implications for livelihood security in terms of better economic- and social outcomes, like food security, employment opportunities, improved division of labor; and improved institutions.

Agricultural intensification is certainly not a new issue in the development arena. However, given the increasing pressure on the demand for food, policymakers have renewed interest in this issue. Furthermore, since the demand of some food items such as livestock products is income-elastic, increases in real income result immediately in an increase in demand (Staal et al. 2001).

Hence, farmers need to keep up pace and respond to this demand. However, agricultural production in most developing countries is dominated by smallholder farmers that face a number of constraints hindering them from improving their productivity. Commonly known challenges include the low volumes of produce, lack of capital and inputs, lack of technical know-how, poor market access, etc. Ruben et al. (2003) point out that limited access to markets and appropriate technologies, as well as low levels of community organization and participation can constrain agricultural intensification in less-favoured areas (LFAs). These challenges bring about transaction costs which negatively affects commercialization amongst smallholders (Bernard et al. 2010). Cooperation among the smallholders and value chain integration can be effective strategies for addressing the before-mentioned challenges.

Could agricultural intensification through cooperative structures be an answer? There are many issues to consider, for instance the use of improved technologies, knowledge systems and the mere governance and structural features of producer organizations. The role of cooperatives as organizational forms for social and economic development, including poverty reduction, is frequently emphasized following the global trends of market liberalization and globalization (Getnet and Anullo, 2012). Cooperatives might enable smallholder farmers to deal with imperfect markets, which are particularly common in remote rural areas, and are considered useful to reduce high transaction costs (UN, 2009). But this process is in no way easy to accomplish due to complex behavioral incentives required for maintaining cooperation. It is possible that cooperatives are a pre-condition in a move to assist farmers out of poverty traps, but without proper evidence on exactly how they can do so and what they require, it becomes difficult to identify concrete measures that can be taken to facilitate cooperatives' contribution.

While the internal dynamics and organization of agricultural cooperatives are widely studied (see Chaddad and Cook, 2004), the role of cooperatives in the process of agricultural intensification has been hardly analyzed. Agricultural intensification is in the literature mainly addressed from the supply-side, focusing on technologies for increasing production and market supply. In this study we seek to address the intensification process from the demand side. Fairly little is known about how farmer organization could be helpful to enhance agricultural intensification. We argue

that a well-organized farmer organization system can stimulate intensification among farmers since it provides guaranteed access to market outlets for their produce. Several other studies (Francesconi and Ruben, 2012; Getnet and Anullo, 2012; Fischer and Qaim, 2012) outline that cooperatives can facilitate the use of high yielding technologies to increase productivity. Moreover, for intensifying agricultural production, smallholder households may require access to a range of support services, including improved seeds, inorganic fertilizers, credit, technical advice, market information, and output-market linkages (Poulton and Lyne, 2009) that are better organized through collective action. Cooperatives can also facilitate information exchange and equip the farmers with useful knowledge through training and extension.

Important issues we seek to address in this thesis are: 1) Can markets be useful to bring about agricultural intensification? 2) Can farmer organizations make intensification easier for smallholders? and 3) How do market integration and farmer organization interact or reinforce each other. We therefore engage a discussion on the role of farmer organizations in agricultural intensification, looking at different types of incentives that play a role in specific sectors.

This thesis does not intend to provide answers to all questions surrounding the issue of intensification (particularly not those which are environment-related) and agricultural development. However, it aims to provide insights to identify appropriate public and private strategies for improving productivity through technological change, investments in knowledge sources for farmers, and support for strengthening the role of conducive producer organizations. We seek to identify the implications of intensification for rural livelihoods, poverty reduction and local community development. The study provides empirical evidence that may assist policy makers and development practitioners in understanding the conditions under which intensification can be achieved, without compromising other elements of the production system. In conclusion, the study is meant to be helpful to contribute to a better understanding on how agricultural intensification can become economically and socially beneficial for marginalized farmers in the Ethiopian countryside.

1.5 Data and Methods

The current study derives its analyses from three separate datasets (honey, dairy and linseeds). The survey on honey was carried out in Masha, a district in the Southern Nations, Nationalities and Peoples' Region of Ethiopia (SNNPRs). Both the dairy and linseeds surveys were carried out in Oromia Region, although in rather different areas. All data was collected through cross-sectional household surveys using structured questionnaires. Lists of cooperative members and individual farmers were obtainable from their respective cooperatives or the cooperative union and Kebele offices respectively, which made it easier for the researcher to rely on appropriate sampling techniques, mainly the proportional random sampling technique. Additional information about the farming and marketing operations (such as product sales and purchases) of the producer organizations (cooperatives or PLCs) was obtained from designated organization offices and the Woreda and Kebele offices. This was done through one-on-one interviews with the organizational managers (primary cooperative or union), processors (e.g. Bezamar, Mama Milk) and other stakeholders from both the non-governmental and governmental organizations. In addition to the information collected through the household survey in the dairy sector, we collected milk samples from the dairy farmers in order to measure selected quality indicators (i.e. fat content, protein content, minerals/salts, freezing point and lactose) in relation to the explanatory variables. This enabled us to assess how quality is related to other milk performance indicators such as production and productivity. Table 1.2 presents general descriptive information on the sample size and composition (total number of producers) and the important variables collected from each of the three value chains.

Table 1.2 Descriptive information on the selected value chains

	Honey	Dairy	Linseed
Region	Southern Nations Nationalities People Regional States (SNNRPs)	Oromia Region	Oromia Region
Study area	Masha	Selale	Arsi Robe
Total number of producers	1,216	3,469	3,613
Sample size	101	384	150
Individual characteristics	Age, gender (dummy), cooperative membership (dummy), education level, beekeeping experience, duration of membership	Age, gender, proportion of female, cooperative membership (dummy), dairying experience, land ownership, land size, family size, distance to milk collection center	Age, terrain of land, land size, gender (dummy), education level (dummy), farming experience
Dependent variables	income from honey sales (birr)	milk production, total milk yield, dairy income; price per liter of milk (birr) cooperative membership	Linseed productivity (kg/ha)

Independent variables	<p>Number of transitional beehives, number of traditional beehives, production from transitional beehives (kg), production from traditional beehives (kg), price/kg of honey (birr), dividend (birr), market channels, sources of income</p>	<p>Breed of cow, feed type, feeding regime, total herd size, total number of (lactating) cows, market channels, milk processing (dummy), distance to watering point, distance to nearest market</p> <p>Milk quality parameters: fat, protein, salts/minerals, freezing point, lactose</p>	<p>Training (dummy), market channels, contract type, production quantities (kg), price/kilo (birr)</p>
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We reviewed ample literature in order to develop a set of explanatory variables for the data analyses. Since the study is of a multi-disciplinary nature, the data collected include socio-economic parameters (such as age of household, income, education level, cooperative membership etc.) and biophysical data (such as the quality parameters of milk: fat, protein, minerals, etc). We first used descriptive statistical analyses to characterize the data. Hereafter, for analyzing the data several econometric and statistical techniques were employed. To answer research question 1, we selected income from honey as the outcome indicators of collective entrepreneurship, which is influenced by institutional and structural characteristic of producer organization such as group size, organization type (cooperative or PLC), etc, as well as by individual characteristics such as age, education level etc. We used ordinary least squares (OLS) regression analysis to identify the factors influencing income from honey. For further interpretation, we also relied on field interviews and secondary data obtained from the primary cooperatives and PLCs.

For answering research question 2, we applied multiple regression analyses to identify the determinants of milk performance, which includes quality, production size and productivity. For research question 3, we used a Probit model to identify the factors influencing the probability of joining cooperatives. We further used propensity scores matching (PSM) techniques to evaluate the impact of cooperative membership among dairy farmers in Ethiopia. This matching technique allows us to compare the treated group with otherwise similar household to ascertain the net impact. For research question 4, we analyze how knowledge systems and their interactions affect productivity among linseed farmers in Ethiopia. We use different specifications of ordinary least squares (OLS) regression to analyze which factors influence linseed productivity.

1.6 Outline of the thesis

The thesis is organized into four chapters. In Chapter 2 we focus on the importance of internal organization in farmer groups among beekeeping producers in Ethiopia. We study the institutional and structural differences of two types of producer groups which facilitate collective entrepreneurship and the acquisition of economic rents among farmers, but with a different

impact on rural intensification. Evidence provided in this chapter suggests that the type of producer organization has a strong influence on the economic performance of farmers due to its effects on improving higher production through technology adoption and higher income through marketing. The performance of farmers within a collective group is influenced by structural factors (such as group size), economic factors (such as market incentives) and farmers' personal characteristics (such as age, education level, gender, etc).

Chapter 3 deals with the identification of the determinants of differences in dairy performance among individual and cooperative smallholder farmers in Ethiopia. This chapter attempt to disentangle the role and importance of different explanatory factors affecting not only quality indicators, but also other key variables of dairy performance, such as productivity and production. Considering these different factors that may influence dairy performance, we analyze the trade-off between quality and productivity amongst cooperative dairy farmers. We assess factors that increase the productivity and quality of milk deliveries, such as the cow breed, cooperative membership, feeding regime, etc. Our findings suggest that cooperatives can be suitable institutions to increase milk productivity to meet the increasing demand for milk and milk products in Ethiopia, but are far less successful in improving quality or for obtaining better prices for their members.

In Chapter 4 we analyze the factors that influence farmers' probability of becoming a cooperative member. Identifying these factors is the first necessary step for assessing impact. We find that socio-economic and locational factors such as age, family size, education level, land size and distance to the milk collection center influence farmers' decisions for joining a cooperative. In the same chapter we analyze the impact of cooperative membership among dairy farmers using a number of different outcome indicators (i.e. production, commercialization, income). Previous studies have suggested that the increasing demand for milk and milk products can be addressed by dairy intensification. Our analysis provides evidence that cooperatives can be suitable institutions to accomplish this, facilitating the use of improved technologies and offering bulking and transport services to their members. This study shows, however, that cooperatives are not offering their members a price which is significantly different from that of

private traders. This implies an important trade-off between the internal functions (facilitating increased production) and the external functions of cooperatives (price bargaining).

Chapter 5 deals with how the different components of the knowledge system influence productivity among oilseeds farmers in Ethiopia. We look at the role of education and training, and then discuss how tacit knowledge derived from farmers' interaction with buyers could facilitate useful information to farmers for enhancing intensification. The training and education programs that are offered to farmers usually concentrate on the production side and neglect the marketing issues. The chapter shows that much knowledge is generated from interactions with value chain partners.

Figure 1.2 summarizes the thesis outline, indicating the main focus of each of the research questions and the indicating the case studies that are used in each chapter:

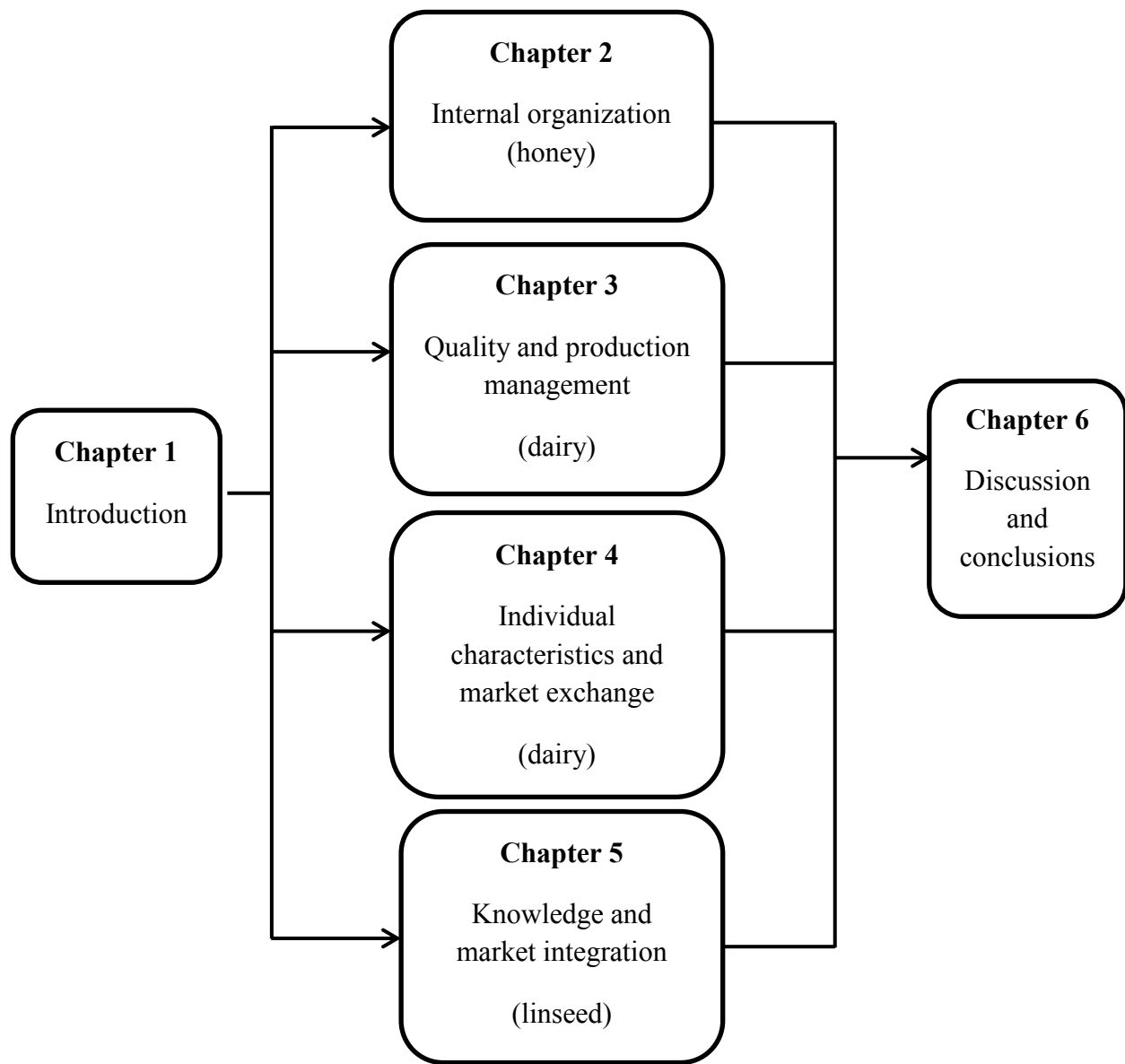


Figure 1.2 Summary of thesis outline

CHAPTER 2. Collective Entrepreneurship and Rural Development: Comparing Two Types of Producers' Organizations in the Ethiopian Honey Sector³

Abstract

This paper deals with the comparison of two types of honey producers' enterprises in the Masha district, western Ethiopia. Cooperatives and private limited companies (PLCs) are both collectively owned by a group of farmers, but the former do not face a legal restriction regarding the number of members, are strongly regulated by the government, and their shares are not tradable. We argue that the collective entrepreneurial capacity varies significantly among the two types of organizations. We find that members of PLCs have higher productivity and income derived from honey, are more prone to adopt new technologies, as well as receive higher dividends and a better price per kilo of honey. Additionally, the incentive scheme exercised by the PLCs is more market-oriented. Furthermore, as compared to cooperatives, PLC members market a higher proportion of honey through their organizations. These results are relevant for the design of development interventions aiming at enhancing market integration of smallholder farmers in Ethiopia.

Keywords: Collective entrepreneurship, collective action, cooperatives, honey, private limited companies, value chain development, Ethiopia

³ A version of this chapter was published as Chagwiza C, Muradian R, Ruben R and Tessema W. (2013). Collective Entrepreneurship and Rural Development: Comparing Two Types of Producers' Organizations in the Ethiopian Honey Sector. In T. Ehrmann et al. (Eds.), *Network Governance*, Contributions to Management Science. # Springer-Verlag Berlin Heidelberg.

2.1 Introduction

The ways that farmers groups function and relate with downstream value chain players (processors, traders, retailing, etc.) are important determinants of economic rents, and therefore they influence the prospects of rural economic development. In agricultural markets dominated by small-scale farmers, producers' groups might play a critical role both for reducing transaction costs for downstream players, as well as for enhancing market opportunities of growers through economies of scale (Mangus and PETERS, 2010). However, the fact of being "organized" is not enough. The manner in which farmers are organized is also critical. In the same market, the type/form of producer organization might have a strong influence on the economic performance of its members. In this study, we seek to assess the relationship between the form of organization and the capacity to seize wealth creation opportunities by members. For doing so, we compare two types of collective enterprises; cooperatives and "private limited companies" (PLCs) involved in the production and commercialization of honey in Ethiopia. The overall objective of this study is therefore to compare the levels of collective entrepreneurship between cooperatives and PLCs, and to discuss how such variation is related to the institutional and structural differences between these producers' groups.

In the study area, both cooperatives and PLCs are producers-owned and run enterprises, with a formal legal status. Both have a board of directors, which is elected by the farmers and both market the largest part of their honey production through a single (the same) processor. Just like cooperatives, a PLC is formed and collectively owned by a group of farmers to pursue their economic goals. The main differences between these two groups are however: (i) *the size of membership*: primary cooperatives can have several hundreds of members while the PLCs are allowed to have a maximum of 50 members; (ii) *the level of external regulation*: cooperatives are strongly regulated by the government through district cooperative offices, while PLCs hold a higher degree of freedom from the government in their operations; (iii) *organizational layers*: primary cooperatives are organized into unions, while the latter level of organization does not exist in the case of PLCs; (iv) *the ownership structure*: PLC members can buy shares, while shares in cooperatives are not tradable. It is important to note that a PLC is also a type of producers' group formed as an alternative to the cooperatives, and the latter have operated in the

area for a much longer period of time; (v) *the functions*: the cooperatives considered for this study are multi-purpose. In addition to honey, they also market other commodities such as peas, beans and spices, while the considered PLCs specialize in the marketing of honey.

The chapter is structured into 7 sections. In section 2.2 we define collective entrepreneurship and discuss its determinants. Section 2.3 provides a brief background of the Ethiopian honey sector. Section 2.4 presents the sampling techniques, type of data collected and the methods used for data analysis. Empirical results are presented in Section 2.5. We discuss our findings in Section 2.6. Finally, conclusion and suggestions for further research are elaborated in Section 2.7.

2.2 Collective entrepreneurship

Collective entrepreneurship (CE) is the process through which the organizational and governance structure as well as the attitudes of members are translated into economic performance and benefits. Yan and Sorenson (2003) also defined CE as a process by which agents are able to identify and seize economic opportunities by means of collective action. CE therefore is determined by social norms, values, and networks for the production of goods or services (Connell, 1999) and the ability to take collective risks (Trompenaars and Hampden-Turner, 2002). Stewart (1989) suggests that collective entrepreneurship might result in an increase in the ability of each member of the group to create and reap opportunities for economic development, as compared to agents that operate by their own. CE changes market conditions by means of building and modifying the organization's resources, competences, and organizational architecture to respond to opportunities and influence market relations (Bratnicki, 2005). Cook and Plunkett (2006) point out that for any form of a collective organization to achieve a higher level of performance, members' decisions about their own (in this case on-farm) activities and investments should be aligned with the cooperative. CE can also be defined as the ability to align these two levels of decision making.

CE is a property of collective enterprises, reflected in their ability to exercise efficiency and accrue rents whenever they are faced with opportunities. The performance of producers' groups depends to a large extent on their level of collective entrepreneurship. In this type of

organizations, individual skills and attitudes are integrated into the group in order to achieve a common economic goal (Dana and Dana, 2007). Collective entrepreneurship is a property of the group, which is determined again by individual behavior. That means that CE results from the interaction between individuals when they face a common economic dilemma (collective action situation). We argue that institutional and structural differences between groups may cause differences in the way in which producer groups react to opportunities and innovations.

A vast literature on management of natural resources has already addressed the factors that are likely to affect collective action, and this body of literature offers numerous lessons that can be applied to collective action in marketing (Markelova and Meinzen-Dick, 2009). Social and economic heterogeneity, group size, and the level of autonomy in setting the rules have been highlighted as important variables determining the ability of groups to solve social dilemmas (Poteete and Ostrom, 2004; Agrawal, 2000). Group size has been identified as a key factor influencing the performance of groups (Olson, 1965; Agrawal and Goyal, 2001; Hussi et al. 1993). The effects of size on performance have been often explained from the perspective of transaction costs. Olson (1965) hypothesized that “unless the number of individuals in a group is small, rational, self-interested individuals will not act to achieve their common or group interests unless certain conditions are present”. In order to solve this free-riding problem, Olson (1971) proposes to create incentives that will induce individuals to contribute to a collective good as a by-product of their pursue of individual interest. The free-riding problem generates monitoring costs. Agrawal and Goyal (2001) and Hussi et al. (1993) argue that the cost of monitoring rise more than proportionately as group size increases. In the same vein, Bandiera et al. (2005) argue that the institutional features that make collective action successful, such as monitoring, are more easily accrued in small groups. Due to the higher monitoring costs, the possibilities of free-riding are higher in large groups. In the same line, Hardin (1982) argues that the larger the number of people who must be coordinated, the higher the costs of organizing them to an effective level. However, the relationship between group size and performance is not as straightforward as we might expect according to the transaction costs literature. The advantages offered by economies of scale in large groups might compensate higher transaction costs.

Apart from size, other factors such as resource characteristics and diversity among members influence the transaction costs of collective action (Ostrom, 1994). Furthermore, social norms and values, such as trust and loyalty, can play a role in the economic performance of collective enterprises, and mediating the relationship between size and group performance. In groups with high levels of social capital, members will forego opportunistic behavior, thereby lowering transaction costs and increasing the group and individual returns (Kirsten, 2004; O'Brien et al. 2005). In addition to the factors discussed above, Aiken and Hage (1971) identified age as another important variable that can hinder innovation in a collective firm or organization. According to these authors, the older the organization, the more bureaucratic and the less receptive it is to innovation. Younger organizations are believed to be in a better position to embrace new technologies and to be more willing to innovate than older organizations. In the current study, we refer to technological innovation as improvements in the way commodities are produced or transformed (Devaux et al. 2007).

Based on these considerations, the conceptual framework for our study is presented in Figure 2.1. We consider the organizational structure (rules and regulations; degree of autonomy), group size, the behavior of members (social capital), the quality of leadership and age as main determinants of CE. The level of CE is reflected in performance indicators, both at the individual and group levels. We consider honey productivity, honey sales, dividends provided, and the level of innovation (adoption of transitional beehives) as most important performance indicators for comparing members of cooperatives and PLCs. These factors, we argue, have a significant influence on the income derived from honey, and therefore on the prospects of rural economic development in the study area. Based on the theoretical considerations summarized above, we adopted the following working hypotheses: (1) PLCs hold a higher level of collective entrepreneurship than cooperatives and (2) Honey producers in PLCs reap higher income from honey, as compared to their peers in cooperatives.

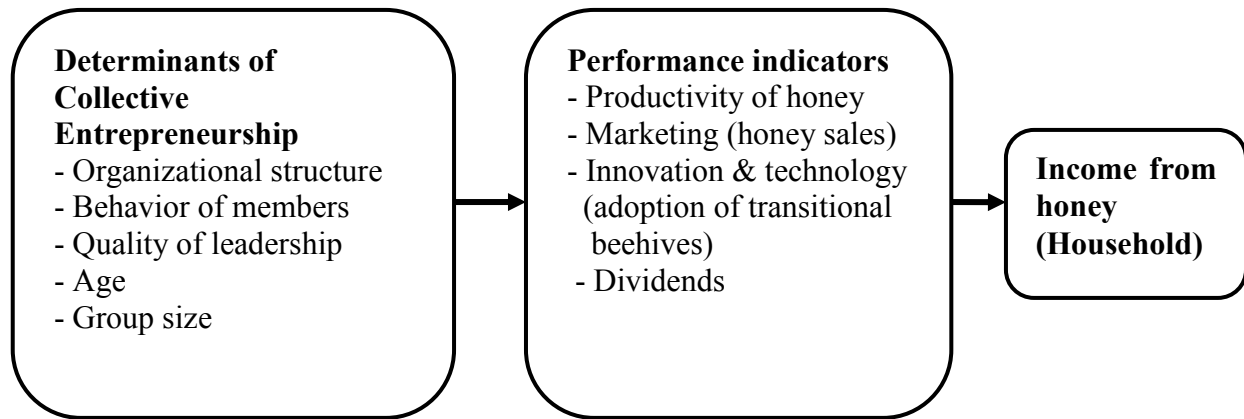


Figure 2.1 Operationalization of collective entrepreneurship

2.3 The Ethiopian honey sector

Beekeeping is a traditional and important farming activity in Ethiopia (Agonafir, 2005). Ethiopia's total honey production is approximately 39,700 tons per year (GDS 2009). The country is one of the five biggest wax exporters, with an average annual export estimated at 3,000 tons (EEPD, 2006). Ethiopia is one of the leading honey producers in Africa and one of the ten largest honey-producing countries in the world. However, honey exports have started only recently, facilitated by interventions of the international cooperation. Currently, the main importers of Ethiopian honey are the USA, Japan and the EU.

Different stakeholders (the government, non-governmental organizations, etc.) have initiated development interventions in the country as a whole and in the study area (Masha district) in particular in order to promote the production and export of honey. The government has given attention to the promotion of improved hives (transitional and modern), which have been provided at subsidized prices through the Ministry of Agriculture and Rural Development. This policy has triggered the participation of women in beekeeping activities since the management of these types of hives requires less physical efforts (they can be placed in the backyard instead of hanging on trees as the traditional hives use to be). The NGOs have facilitated the adoption and use of low-cost and appropriate hive technologies and have provided training to the beekeepers.

Small-scale producers are the most important honey producers in Ethiopia. The main buyers for the honey produced in Masha are private traders (local merchants), local *Tej* (Ethiopian traditional honey liquor) brewers, and the lead firm Bezamar, a honey processing, trading and exporting company. A lead firm can be described as a firm that has forward and backward commercial linkages with a number of small-medium enterprises within the value chain and holds a significant market share and power in the sector. Contracting relations between the private sector and honey producers and their organizations (e.g. farmers' groups) is considered essential to effectively align production, processing, and the specific demands and standards of the international market. Thus, in order to satisfy the market requirements on quality and volumes, producers (suppliers) and buyers (processors) need to closely coordinate their activities. As a result, their degree of interdependence is increasing. The owner and manager of Bezamar is one of the key entrepreneurs who have facilitated the transformation of the honey sector in Ethiopia. The Dutch development agency SNV promoted a mutually beneficial relationship between the producer groups and the lead firm through the provision of grants for training on quality, technology transfer; and business development services.

Beekeeping requires techniques that can be easily managed and it does not require investment to acquire big land areas, which is often a constraint for the poor rural dwellers (Debela, 2010). In Ethiopia, there are 3 types of bee husbandry systems namely: traditional, transitional and modern beekeeping. In the traditional way of beekeeping, the hives are made out of logs, bark, reeds, gourds and clay pots. The hive has to be hanged on top of a tree (in the forest). The number of traditional beehives a household might handle is very high (up to 200) but yield per hive is very low. Kerealem et al. (2009) report that about 95 percent of bees are still kept in traditional hives. The term “transitional beehive” refers to a hive technology that is between the traditional and the modern one, and it is managed at the backyard. Transitional hives are made of local wood, and they have typically a higher honey yield, compared to the traditional hives. They provide also a mechanism for monitoring the maturity of honey, thus enabling harvest at optimal time. Finally, modern hives are created from rectangular and square boxes of better quality wood. These include Langstroth and Top Bar hives. The modern hives are more complex and difficult to build

but they are easily transportable and generate greater quantities of better quality honey, which will command higher prices (Mehari, 2007).

The three types of bee husbandry systems described above have different costs, harvesting techniques and productivity expectations (GDS, 2009). By adopting the transitional and framed (modern) types of hives, alongside with proper training on management of the honeybees, producers can harvest higher yields. The average potential yield for each type hive is shown in Table 2.1.

Table 2.1 Average Yield Potential per each hive type

Hive type	Farmer's Average Yield (kg/hive)	Research Center ⁴ Yield (kg/hive)
Traditional	5.0 - 7.0	n.a
Transitional (intermediate)	15.0 - 25.0	25
Framed (boxed)	30.0 - 45.0	40

Source: Global Development Solutions, LLC (2009)

2.4 Methodology

This section describes the study area and the sampling strategy applied in the selection of the respondents, as well as the procedures for data collection; the source of data, the type of data collected and the methods used for data analysis are also described.

2.4.1 Description of the Study Area

Fieldwork was carried out in the Masha district, South west part of Ethiopia. Masha is one of the 77 *woredas*⁵ in the Southern Nations, Nationalities and Peoples' Region of Ethiopia (SNNPRs). Different nationalities are found in this zone, including Shekicho, Sheko, Megzenger, Keficho, Amhara, Oromo and Guraghe. This *woreda* falls under the Sheka Administrative Zone (see

⁴ Research centre refers to the centre built for scientific research.

⁵ *Woredas* or districts are the third-level administrative divisions of Ethiopia. *Woredas* are composed of a number of wards (*kebele*), or neighborhood associations, which are the smallest unit of local government in Ethiopia.

Figure 2.2). More specifically, Masha is the administration center of Sheka Zone and is located 676 km south west from Addis Ababa, along the Addis-Jimma road. Geographically, the Zone lies between 7°24'–7°52' N latitude and 35°13'–35°35' E longitude.

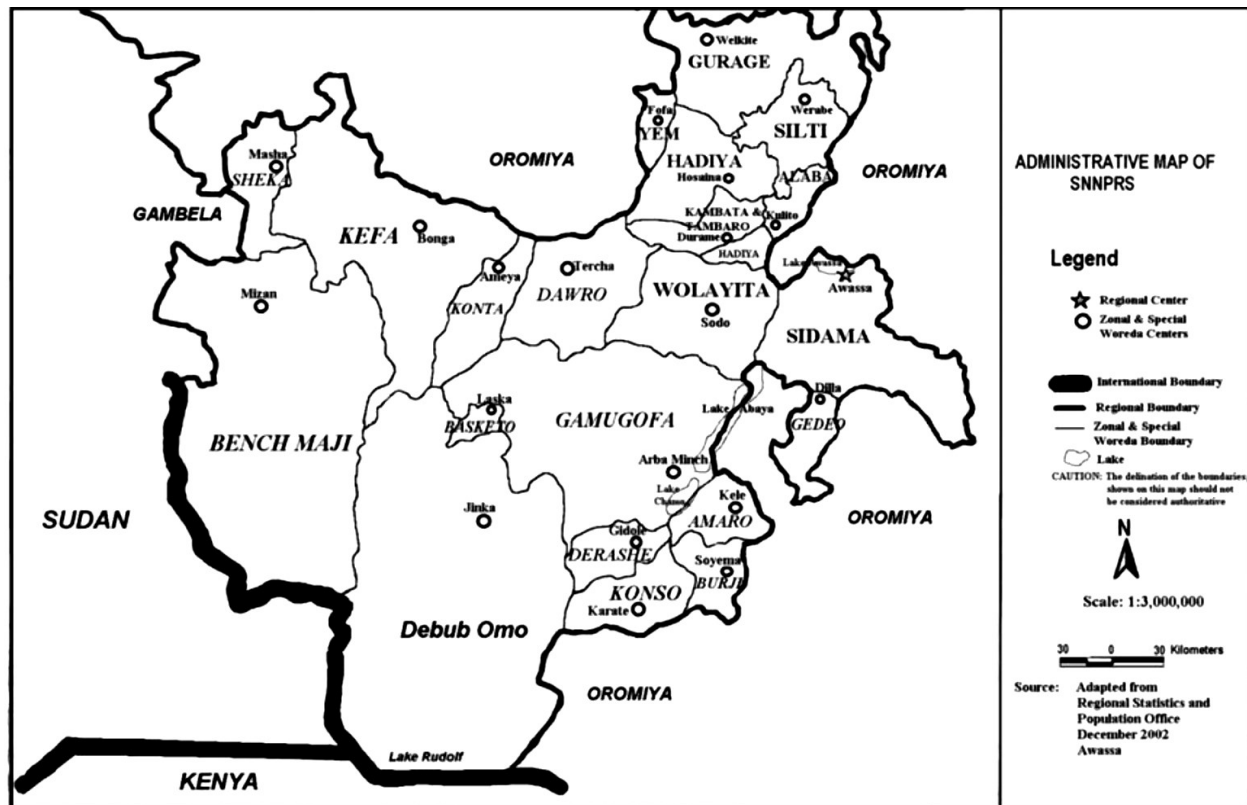


Figure 2.2 Map showing the study area Masha-Sheka Zone (Abbute 2003)

The altitudinal range of the areas in the Zone is between 900–2,700 m above sea level, and it receives a high amount of rainfall, with an average of 2,000 mm annually. This woreda is notable for its relatively high forest cover as compared to other parts of Ethiopia. In general, the area is characterized by dense forests and woodlands containing diverse plant species that provide nectar and pollen to foraging bees. However, this important attribute is threatened by the high rate of deforestation in the area, which has aggravated in recent years due to increased conversion to monoculture plantations such as coffee and tea.

2.4.2 Sampling Strategy and Data Collection

Out of the five cooperatives (one per kebele)⁶ producing honey in the district, three primary cooperatives (Genobay, Akach and Degele) were selected for the study. Accessibility was taken into consideration in selecting these primary cooperatives. A number of 60 producers (20 from each cooperative) were selected randomly from a list obtained from the cooperative marketing office. 58 producers participated in the survey and the remaining two could not participate due to various reasons. All the members from the 3 operational PLCs in the district (Chiefdale, Gada and Shatto) were included in the survey, since the smaller membership size of the PLCs allows interviewing all the members. In total, 43 PLC members were interviewed. The total membership (group size) and number of members of the collective enterprises that participated in the survey are shown in Table 2.

Table 2.2 Number of members in the producers' groups that participated in the study

Organization	Total no. of members	No. of participants/group
Gada PLC	14	12
Chiefdale PLC	17	15
Shatto PLC	19	16
Akach primary cooperative	445	19
Degele primary cooperative	270	19
Genobay primary cooperative	451	20

Data was collected from March to April 2011, through a household survey applied to 101 households, as indicated above. A semi-structured questionnaire was designed to generate information in the following fields: duration of membership, main source of income, dividend, annual income from honey, number and type of beehive owned, constraints of beekeeping, perceptions of the producers on the transitional beehives, amount of honey harvested, price

⁶ A *kebele* is defined in Ethiopia as the smallest administrative unit, below the municipality-district level.

received per kilogram of honey, year of adoption of transitional beehives and beekeeping experience. Face-to-face interviews were also conducted with the management teams of the producers' organizations (cooperatives and PLCs), private traders, and the processor (Bezamar). More relevant secondary information and data were gathered from various institutions, including the zonal and *woreda* sector offices. Documents from NGOs (SNV and NTFP) active in the study area were also consulted and reviewed.

Data was analyzed using the Statistical Package for Social Scientists (SPSS) 19.0 for Windows. T-test and χ^2 were employed to test the significance of differences between groups for continuous and discrete variables, respectively. We ran a regression on income from honey sales, in order to assess the explanatory power of different independent variables.

2.5 Empirical results

The presentation of results on the comparison of the two producers' groups (cooperatives and PLCs) is guided by the hypotheses outlined in the previous section.

2.5.1 Socio-economic characteristics of respondents

The frequencies of several socio-economic indicators are summarized in Table 2.3. Most of the households interviewed were male-headed. Across the two types of producers' group (coop and PLCs), most beekeepers (83%) were 34 years or older. 78.3% of respondents went to school, and the majority has completed the primary education. About 23% of respondents indicated that they have never been to school. We did not find significant differences in education levels between members of cooperatives and PLCs.

Table 2.3 Distribution of respondents according to age and education

Variable	PLCs (43)			Coops (58)		
	Count		%	Count		%
Gender						
Female	9		20.9	2		3.4
Male	34		79.1	56		96.6
Total	43		100	58		100
Age groups						
24 & below	1		2.3	1		1.7
25-34	9		20.9	7		12.1
35-44	14		32.6	21		36.2
45-54	14		32.6	13		22.4
55-64	5		11.6	15		25.9
65 & above	0		0	1		1.7
Total	43		100	58		100
Education level						
Never been to school	10		23.3	12		20.7
Primary school	8		18.6	15		25.9
Secondary school	19		44.2	24		41.4
High school	6		14.0	7		12.1
Total	43		100	58		100
Sources of income	Count		%	Count		%
1 st choice	Honey	25	56.8	Kocho	22	62.9
2 nd choice	Kocho	13	46.4	Honey	19	61.3
3 rd choice	Livestock	18	51.5	Livestock	17	48.6

About 72 % of all the respondents report beekeeping experience of 20 years or more. The minimum and maximum numbers of years of experience indicated by respondents were 2 and 48 respectively. 49 % of the respondents have been members of their organizations for 8 years or more. The longest time of membership by cooperatives members was 19 years. PLC members ranked honey as their main source of income, followed by kocho (banana-like tree whose stems are edible) and lastly livestock. For cooperative members, their main source of income was kocho, followed by honey and then livestock.

2.5.2 Performance at household and group level

Level of adoption of transitional beehives

In the study area, the use of transitional beehives was low across the sample. However, we found that PLC members owned a significant higher number of transitional beehives in 2007 and 2010, as compared to members of cooperatives (see Table 2.4).

Table 2.4 Summary of independent-samples t-test results

Variables	Cooperatives (58)		PLCs (43)		(Differences)	
	Mean	SD	Mean	SD	T-stat	P-value
Socio-economic variables						
Beekeeping experience (years)	26.29	11.06	26.23	10.15	-0.028	0.978
Duration of membership (years)	13.03	4.35	6.12	1.12	-11.610	0.000***
Production and income variables						
Number of transitional beehives in 2007 (unit)	0.31	1.08	2.09	3.06	3.654	0.001**
Number of transitional beehives in 2010 (unit)	1.48	1.64	4.56	3.71	5.080	0.000***
Production transitional 2007 (kilograms)	3.28	13.81	21.26	35.97	3.112	0.003**
Production transitional 2010 (kilograms)	12.47	21.05	53.51	56.38	4.545	0.000***
Production change transitional (kilograms)	9.10	17.50	32.26	62.01	2.37	0.022**
Productivity of honey (kg/hive)	2.47	1.83	3.48	2.14	2.560	0.012**
Income honey sales 2008 (Birr)	1075.84	863.63	2542.59	2014.24	4.480	0.000***
Income honey sales 2010 (Birr)	1615.50	1229.49	4060.21	2740.78	5.456	0.000***
Dividend paid (second payment) (Birr)	14.93	46.18	276.95	308.72	5.520	0.000***

Note: **significant at 5%; ***significant at 1%

The beekeepers were asked whether they were willing to give up traditional beehives and focus only on transitional beehives. 89% of all the respondents answered “Yes”. The results reveal that there is no significant difference between the two groups with regards to their willingness to give traditional hives up for transitional hives (see Table 2.5).

Table 2.5 Summary of Pearson χ^2 test results

Organization variables	Coop (58)	PLC (43)	χ^2 Value	Asymp. Sig (2-sided)
	Yes	Yes		
Dividend	18	<u>22</u>	4.183	0.041**
Marketing channels:				
(1) Own organization	43	<u>42</u>	10.26	0.001**
(2) Private traders	<u>37</u>	8	20.41	0.000***
(3) Neighboring coops	0	2	2.75	0.097
Willingness to give up traditional beehives	52	38	0.042	0.838
Advance payment from organization	0	<u>5</u>	7.095	0.008**
Receive equipment	10	<u>16</u>	5.150	0.023**

Note: **significant at 5%; ***significant at 1%

Dividend for members and incentives to the management team

Our results show that PLC members receive a significant higher amount of dividends (second payment), compared to members of coops (see Table 2.5). In addition, we found a statistically significant difference between the two groups in relation to the proportion of farmers that received dividends (see Table 2.6). Producers highlighted a number of reasons why they did not receive dividend from their organizations. The information was generated only from the members who indicated that they did not receive dividends (coop=40, PLC=21). The most important reason given by members of both types of groups was the need to re-invest for the expansion of the business.

By incentives we refer to the payment or compensation given to the board members of an organization for their managerial tasks. The board members of the PLCs are entitled to 10% of the net profits made by the organization. However, at the moment fieldwork was conducted they have agreed not to claim it, but to invest it back into the organization. During the interviews, unlike in PLCs, all cooperative board members revealed that they are not entitled to receive incentives; rather they receive perdiems if they attend meetings or workshops. They mentioned as their main motivation to be a board member their willingness to contribute to societal goals and the common good.

Honey productivity

Overall honey productivity was calculated as follows:

$$\text{Honey productivity} = \frac{\text{Quantity of honey (kg)}}{\text{Number of beehives (traditional + transitional)}}$$

The mean annual honey yield from transitional beehives (for the whole sample) in 2010 was 10.7 kg/hive/annum. The yield was far below the expected yield from transitional beehives: 15.0-25.0 kg/hive/annum (GDS 2009). For the traditional beehives, the mean annual yield was 2.1 kg/hive/annum, which is also below the expected yield of 5.0-7.0 kg/hive/annum (GDS 2009). Cooperative members reported significant lower quantities of honey produced from transitional beehives in 2007 and 2010, as compared to PLC members.

Our findings suggest that members of PLCs have higher honey productivity, as compared to members of cooperatives (see Table 2.5). In addition, we used the quantile method for classifying the households according to their productivity level. The data was arranged in descending order. The 101 households were grouped into 3 classes; high, medium and low, according to their productivity performance. The results from the comparison show that all the 3 PLCs (Gada, Chiefdale and Shatto) have higher percentages of their members in the higher ranks

(33, 27 and 50 respectively) as compared to the 3 cooperatives (Akach, Degele and Genoby), with 21, 10 and 20 respectively.

Honey Prices

Figure 2.3 presents how prices paid by cooperatives, PLCs and private traders have evolved across time. Producers delivering their honey to PLCs are consistently receiving better prices than those delivering to cooperatives and private traders. More interestingly, the figure shows that, except for 2007, the private traders are offering higher prices than cooperatives but less than PLCs.

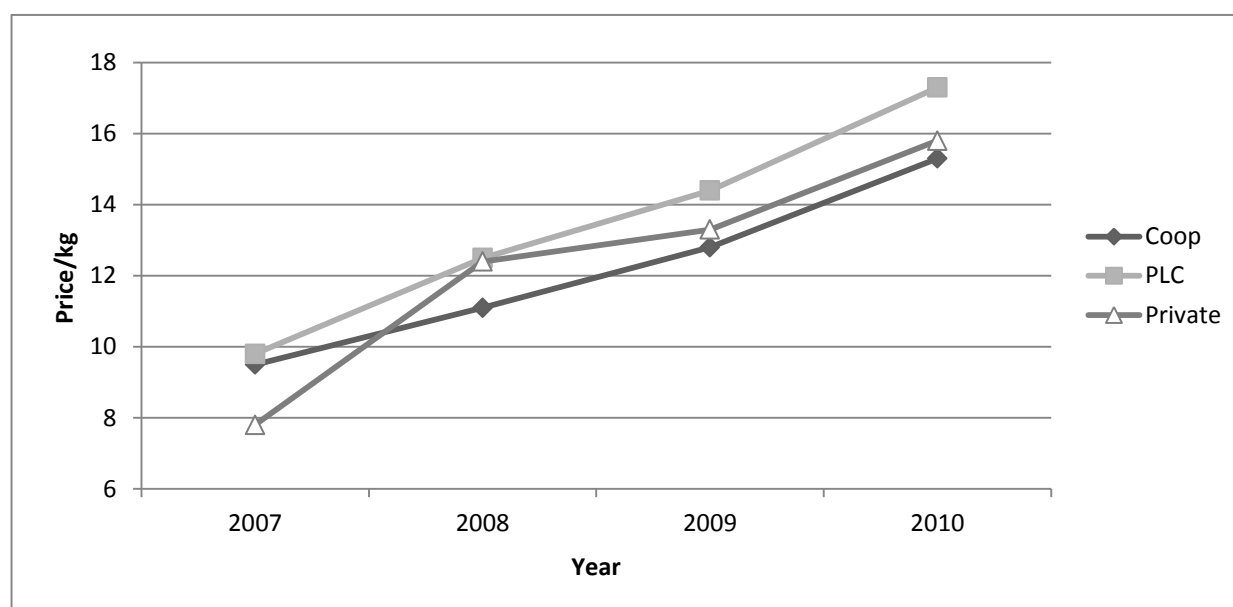


Figure 2.3 Price variation among buyers across years

In addition, an independent-sample t-test was used to compare means of the income obtained from honey for the years 2008 and 2010. Table 4 clearly shows that PLC members obtained significantly higher incomes from honey sales as compared to members of cooperatives.

Perceptions about the Effect of Improved Hives and Training on Income

Respondents were asked to respond to the statement “I am very satisfied with my income over the past three years as a result of the training on beekeeping”. Answers were ranked on a 5 point-Likert scale from strongly disagree to strongly agree. The results indicate that significant

differences ($p < 0.05$) were observed between the responses from members of PLCs and cooperatives. 49% of the PLC members tend to strongly agree with the statement as compared to only 24% of cooperative members ($p = 0.01$).

The respondents were also asked to give their responses on the statement “As a result of the training and access to modern technologies on beekeeping, I would confidently say that my household income has.....” For answers we used a 3 point-Likert scale with the following options; increased, slightly increased and remained the same. Across the two groups, about 65 percent of the whole sample indicated that their income has increased. However, significant differences ($p < 0.05$) were again observed between the means of PLC’ and cooperative’ producers.

2.5.3 Marketing

Three marketing channels were identified among respondents: own organization (cooperative or PLC), private traders and neighboring cooperatives. Choice and utilization of marketing channel varies significantly ($p < 0.05$) across producer organization (coop or PLC). 64% of cooperative members are marketing a proportion of their honey through private traders, whereas only 19% of PLCs sell part of their production through this channel (see Table 2.6). Bezamar (honey processing and exporting company) is the main buyer of honey from both the cooperatives and PLCs. Producer groups buy honey from their suppliers (members), bulk it and sell to the processor. The honey sales reported by both PLCs and cooperatives from 2007 to 2010 are shown in Figures 2.4 and 2.5 respectively.

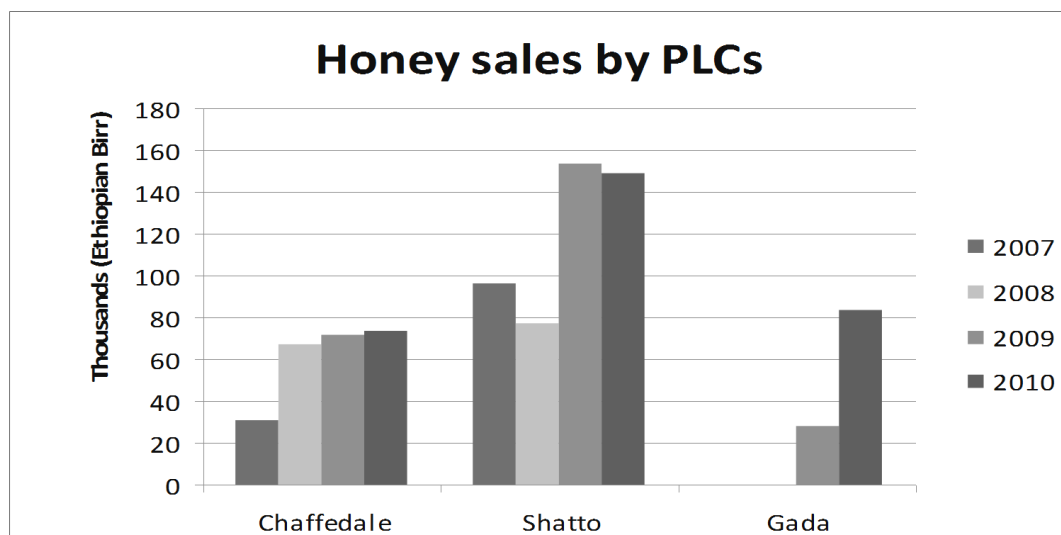


Figure 2.4 Honey sales by PLCs

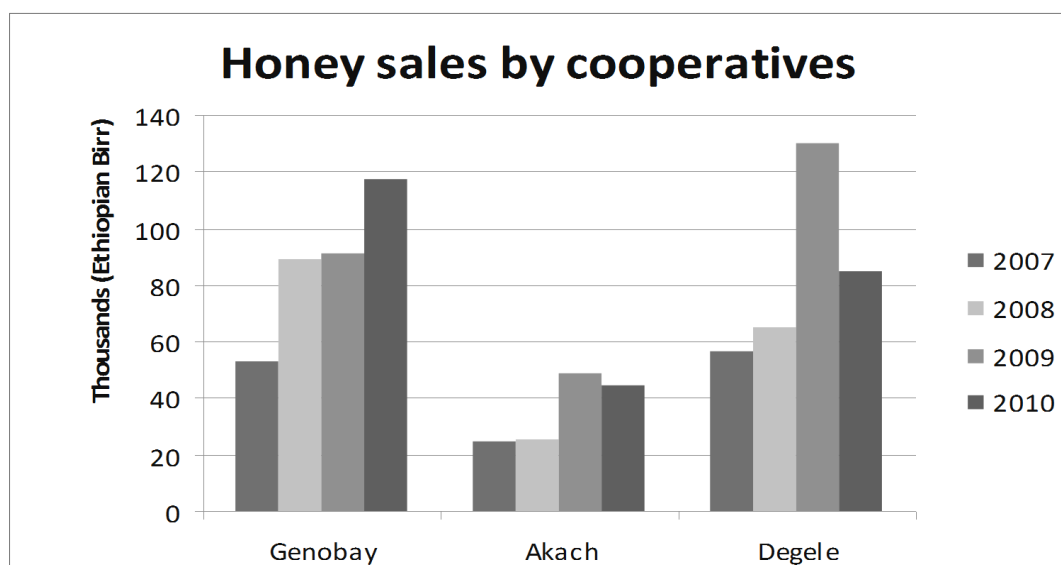


Figure 2.5 Honey sales by cooperatives

Marketing constraints

Despite all the benefits that honey can bring to the beekeepers in the area, the producers are confronted with a number of challenges and constraints that can potentially hamper the future of honey production and the economic contribution it brings to their livelihoods.

Table 2.6 Marketing constraints as reported by the beekeepers

	Challenge	Number of respondents (coop = 58)	%
1	Low price of honey	15	26
2	Lack of access to credit	9	16
3	Lack of support from the union	8	14
4	Private trader cheats on price and weight	6	10
5	Lack of capital for organization to buy all our honey	5	9
6	Transport problem	5	9
7	Fewer buyers	3	5
8	Unable to get timely information	2	3
9	The organization does not buy honey on time	2	3
10	The coop cheats when weighing honey	2	3
		Number of respondents (PLC = 43)	%
1	Low price of honey	16	37
2	Lack of access to credit	7	16
3	Few buyers	6	14
4	Lack of capital for organization to buy all our honey	4	9
5	Unable to get timely information	3	7
6	Private traders cheats on price and weight	2	5
7	The organization does not buy honey on time	2	5
8	Transport problem	1	2

We present separately the constraints identified by cooperatives and PLC producers (see Table 2.6). Beekeepers of the two types of groups ranked low price, and lack of access to credit as the most important constraints. As the third most important constraint, cooperative members indicated that they lack support from the union, while the members of PLC stated that they would like to have more buyers.

2.5.4 Regression results

In order to identify the determinants of income from honey sales, we run a regression analysis (OLS) taking household and organization characteristics as independent variables, according to the following model:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \quad (1)$$

where Y is the dependent variable (income) and X_1, X_2, X_3, \dots are the explanatory variables. We present the dependent variables, explanatory variables, expected signs and the description of the expected relationships (see Table 2.7).

Table 2.7 Variables and their expected signs

Dependent variable	Explanatory variables	Expected sign	Description of relationship
Income from honey	Education level	(+)	Knowledge and skills in production and marketing should influence positively income from honey
	Age	(+)	More experience in production and marketing is expected to translate into higher income from honey
	Gender (0=female, 1=male)	(+)	Males are expected to have better access to market information
	Duration of membership	(+)	Producers with more years of membership are expected to be more

			knowledgeable and experienced about the market, and hence able to reap higher income from honey
	Total number of transitional beehives	(+)	More transitional beehives translate into higher productivity, thereby increasing income from honey
	Productivity	(+)	Higher productivity results in an increase in income from honey
	Organization type (0=PLC, 1=coop)	(-)	PLC members are expected to have higher income from honey sales

For this analysis, we used the income from honey sales for 2010 as the dependent variable. Our regression results show that 30% of the variation in income from honey is explained by the considered explanatory variables (see Table 2.8). We checked for collinearity using the Variance Inflator factor (VIF) and the Durbin-Watson test.

Table 2.8 Factors influencing income from honey sales (OLS regression analysis)

Model	B	Std. Error	Beta	t	Sig.
(Constant)	2.783,373	983,715		2,829	0,006**
Education level	-50,021	232,288	-,021	-,215	0,830
Total number of transitional beehives	37,984	26,826	,145	1,416	0,160
Duration of membership	69,921	66,011	,143	1,059	0,292
Gender of the respondent	145,067	676,945	,019	,214	0,831
Age	-3,507	225,978	-,002	-,016	0,988
Organization type	-2.194,744	671,394	-,465	-3,269	0,002**
Productivity	107,271	37,015	,262	2,898	0,005**

Dependent Variable: Income from honey sales (2010)

**significant at 5%

Adj R² = 0.30; Durbin-Watson = 1.914

Significant variables include the organization type and productivity. Organization type (0=PLC, 1=coop) is negatively related to the income from honey sales. Productivity of honey has a positive relationship with the income derived from honey sales.

2.6 Discussion

In this section we address the two main overarching questions based on the findings presented above: (1) Why do PLCs hold in a higher level of collective entrepreneurship? and (2) Why do cooperatives remain operational in the area?

We evaluated CE in two types of farmers' organizations by means of using a number of parameters characterizing the performance of collective enterprises, including, but not limited to, the rate of adoption of new technologies (process upgrading), member loyalty (in supplying output to his/her own organization), dividends and incentive schemes for board members. Based on these indicators, our main overall finding is that PLCs hold a higher level of collective entrepreneurship as compared to cooperatives. The difference in the level of collective entrepreneurship is expected to be influenced by a number of factors. As mentioned earlier on (see Section 2.2), group size is one variable that has been mentioned in the literature as an important determinant of group performance when they deal with collective action situations. Smaller groups tend to realize lower transaction costs as compared to larger groups. Institutional economists have argued long ago that transaction costs are a key element explaining the performance and survival of collective endeavors (North, 1990). In addition, social capital features related to the performance of groups such as trust, commitment, participation and loyalty might be affected by the group size. For instance, Nilsson et al. (2009) report an inverse relationship between group size and membership satisfaction and trust in leadership among traditional cooperatives in Sweden.

Furthermore, Jones (2004) argues that individuals in small groups can expect personal action to prove 'significant' (for example, to affect the probability that others will contribute). In addition, previous studies (see Sykuta and Cook, 2001; Chaddad and Cook, 2004) have shown that a major problem associated with collective action in cooperatives is that members' property and

decision rights tend to be vaguely defined in this type of enterprises. This causes social tensions amongst members. This is more likely in larger groups, since they are more likely to experience higher levels of agency costs, free riding or apathy in terms of monitoring (Chambers, 2007). Vague property rights are more pronounced in larger groups because of higher degree of heterogeneity of economic interests among members. In addition, as membership becomes more heterogeneous the degree of vaguely defined property rights increases (Chaddad and Cook, 2004). In our case, PLCs, being smaller and more homogenous, have clearer property and decision rights (it is less costly to take collective decisions). In addition, property rights are flexible (shares can be bought).

However, contrary to the previous argumentation, Agrawal (2000) found a positive relationship between group size and success in raising resources needed to hire a guard for protecting forest resources (a typical collective action situation). In a similar vein, Agrawal and Goyal (2001) found medium-sized groups to be more effective than smaller and larger groups, in the management of common-pool resources. Nonetheless, Barham and Chitemi (2009) found no evidence of any relationship between the group size and performance of the group in Tanzania. The downside of small groups is that they often lack economies of scale, a particular advantage in marketing and for achieving efficiency (Markelova et al. 2009). As the studies mentioned above show, the relationship between group size and collective action is not always straightforward. Ostrom (1997) argues that the impact of group size on collective action is usually mediated by a variety of other variables. We deal with some of them below.

There are several institutional factors that influence the performance of groups when dealing with collective action problems. North (1990) defined institutions as humanly devised constraints, formal (rules, laws, constitutions) and informal (norms of behavior, conventions and self-imposed codes of conduct) that structure human interactions, and their enforcement characteristics. An important set of institutional factors have to do with the type of rules that, according to Coleman (2009), are used to effectively manage long-term collective endeavors. Moreover, the rules that govern an organization influence the extent to which collective entrepreneurship is realized. Absence of rules or poor monitoring of rules is consistently

associated with poor performance of common-pool resources (Ostrom and Nagendra, 2006). For instance, Coleman (2009) highlights that issuing harvesting rights to local users provides incentives to invest in the common forest and results in good forest condition. Well structured incentive schemes and the right to buy shares within the PLCs are some of the rules that can facilitate collective entrepreneurship. Unlike PLCs, all cooperative board members do not receive monetary incentives for the work they do and during the interviews they justified their unpaid managerial tasks as a contribution to the common good and a social duty. Furthermore, the possibility to buy shares gives PLC members an incentive to be loyal to their organization, to increase honey sales and consequently to reap higher economic benefits derived from collective action. In this line, Chambers (2007) states that loyalty may be a form of selective social incentive or social coercion that maintains a collective business.

Livelihood strategies might be another important factor influencing the level of collective entrepreneurship. Cramb (2000) suggests that farmers in the same environment may have different objectives and livelihood strategies, and so respond differently to a given technology or innovation. The fact that PLC members consider honey to be their highest source of income (whereas kocho is the main source of income for cooperative members) might explain the differences in the rate of adoption and use of transitional beehives. PLC members have clearer incentives for their adoption. Another factor that might contribute to explain the differences between PLCs and cooperatives is the level of external influence on the organizations. There is a much higher level of external influence (government control) on cooperatives, as compared to PLCs. During our interviews, some PLC members pointed this as one of the advantages of their organizations. In this regard, Coleman (2009) argues that externally imposed rules and monitoring institutions have often failed in inducing effective management of common pool resources.

Nevertheless, the differences we have found in the level of collective entrepreneurship might also be due to selection bias. It could be the case that more productive and entrepreneurial producers tend to prefer join PLCs. However, our data does not allow us to assess the importance

of selection bias in explaining the results. In any case, it is likely that a better performance attracts more entrepreneurial farmers, inducing virtuous cycles among PLCs.

If PLCs hold a higher degree of collective entrepreneurship and seem to be dominating in the supply of honey, one may wonder then why the cooperatives still remain operational in the area. There are several reasons that can explain this phenomenon. First, one possible explanation has to do with the multipurpose nature of cooperatives. Besides marketing of honey, the cooperatives also engage in trading of other agricultural commodities like peas, beans and spices. During our interviews, the cooperative members highlighted this multipurpose nature as an important feature of cooperatives. Farmers are able to market their various commodities at one place thereby reducing transaction costs that arise from searching for buyers and transportation. The lower level of efficiency for marketing of honey might be offset by other services offered by the cooperative.

Secondly, there might be an information gap/inadequate information amongst the cooperatives members about the performance of other collective enterprises that they could join. For example, cooperative members might lack information about how PLCs are functioning and performing. The third reason has to do with the high start-up costs. The initial investments required to set up a collective enterprise in the study area are high. PLCs were heavily subsidized (financially, as well as through capacity building and other services) during their establishment by international cooperation agencies. It is likely that without this financial support it is extremely difficult to set up new collective enterprises.

2.7 Conclusions

Our findings shed light on the importance of organizational features, such as group size, rules and incentives, for the successful implementation of rural development interventions. Some policy recommendations can be derived from our study. For instance, the division of large cooperatives into smaller subgroups might facilitate collective entrepreneurship. Additionally, very likely cooperatives will reap efficiency gains if they change their incentive mechanisms. For example, they could adopt a system where board members benefit from the organization's

profits, as a way of motivating them to invest in the common good. They could also allow members to trade shares. However, we should be careful about generalizations. The conclusion that PLCs are more entrepreneurial than cooperatives should not be generalized across all sectors and regions. The relationship between organization type, size and performance among collective enterprises run by farmers requires much further research in Ethiopia before we can arrive to robust policy recommendations.

Producers groups in the Ethiopian honey sector have the potential to promote exports of honey from the area (capitalizing on supplying organic and forest honey) and improve the livelihoods of the rural households through increased income from honey sales. This has attracted the attention of the government, non-governmental organizations and private players in the sector. However, the way farmers are organized (organizational type) influences the performance of these collective enterprises. We addressed empirically these issues by comparing the levels of collective entrepreneurship between cooperatives and PLCs, and discussed how such variation is related to the institutional and structural differences between the two types of groups. The analysis shows that PLCs demonstrated a higher level of collective entrepreneurship as a result of some qualities (specialization, member loyalty, incentives, social capital with buyer; and group size) that they possess over their counterparts, cooperatives.

CHAPTER 3. Determinants of performance among small-scale dairy producers in Ethiopia: trade-offs between productivity and quality⁷

Abstract

This paper uses data from 384 Ethiopian smallholders to empirically investigate the determinants of milk performance (production, productivity and quality). Two different groups of milk producers (cooperative members and non-members) were considered. The study was conducted in Selale, Oromia Region, one of the most important milk production areas in Ethiopia. Milk samples for physio-chemical analysis were collected from households. The results show that breed type, feed type, feeding regime, cooperative membership, education and number of lactating cows are the most important factors influencing milk performance. This study suggests that cooperatives can be suitable institutions to increase milk productivity and facilitate the dissemination of dairy technologies. However, factors that influence positively on productivity, including cooperative membership, often have a negative effect on some quality indicators.

Keywords: Dairy, milk quality, milk productivity, cooperatives, Ethiopia.

⁷ This chapter is based on a paper which is submitted to a book on Producer Organizations and Rural Development

3.1 Introduction

Milk quality is a relative concept. It depends on the preferences of final consumers and processors, which might vary significantly. For instance, some consumers may consider fresh milk rich in fat as high quality, while others can have a strong preference for milk that have been the subject of de-creaming and fat-reduction processes (Otwori, 2006). Likewise, processors may consider fat content as a key quality indicator, since it influences considerably efficiency during the elaboration of dairy products such as butter and cheese (D'Haese et al., 2005; Sraïri et al., 2009). Muller and Robertson (2004) argue that dairy processors need milk of a higher fat and protein content in order to keep the production cost of dairy products low. Due to the relative nature of quality, Romano et al. (2006) conclude that preferences of milk buyers are the most important factor to be considered when dealing with dairy quality. Though there is not much empirical and systematic evidence about milk preferences among the diversity of milk consumers in Ethiopia, for this study we take into consideration a wide set of quality indicators. We expect that the results of our analysis can contribute to understand the relationship between the outcome of production systems and consumers' preferences. Such relationship influences the economic prospects of rural producers, as well as it is key for the well functioning of value chains.

Zuniga-Arias et al. (2008) have proposed that the factors determining quality attributes of agricultural products can be classified into the following categories: individual / households' characteristics, management activities, production system characteristics and economic attributes. A similar classification can be followed to assess the determinants of quality in the dairy sector. In addition, we could classify the factors influencing the physical-chemical composition and production of milk into intrinsic and extrinsic. Intrinsic factors refer to variables such as stage of lactation, breed type and age of the cow. The following variables are considered as extrinsic: feed type, frequency of watering, distance to watering point, etc. Furthermore, milk quality and production are influenced by socio-economic factors at the household level, including for example the level of education, experience, credit availability, etc. The most common physical-chemical parameters of cow milk are fat content, protein content, salts (minerals), water content, milk temperature, freezing point, density, lactose (carbohydrates) and

solids-non-fat (SNF). The interpretation of the most important of these parameters is explained in the next section. All these variables are influenced by the set of factors described above.

The main objective of this study is to disentangle the role and importance of different explanatory factors affecting not only quality indicators, but also other key variables of dairy performance, such as productivity and production. We pay special attention to analyze the role of cooperative membership as a variable mediating this trade-off. Dairy cooperatives are assumed to provide different services that are expected to influence dairy performance among members in a way that is positive for their market integration, and therefore for the prospects of rural economic development (Holloway et al., 2000). However, at least in Ethiopia, the evidence about these effects, and in particular by means of systematically comparing performance of members and non-members of cooperatives, is very limited. In addition to determining the factors influencing dairy performance among small-scale landholders, our study is also expected to contribute to understand the mechanisms through which dairy cooperatives can play a role in facilitating rural economic development and agricultural intensification.

Smallholders are vital players in the Ethiopian dairy value chains since they dominate the sector in terms of supply. Small dairy producers in developing countries vary considerably in their level of intensification, even within the same location. Intensive dairy systems are typically characterized by a higher use of crossbreed cows and agro-industrial feed concentrates, which increases milk productivity but also production costs. In contrast, farmers who adopt extensive dairying systems rely more on less productive but less costly to maintain local cow breeds. In extensive systems, farmers feed their cows with less nutritive pastures as a way to reduce production costs (Alvarez et al., 2008). These two systems render different outcomes. Such outcomes may show trade-offs between different properties of the milk production systems (e.g. productivity and quality), but also between the performance of such systems and socio-economic indicators at the household level. The circumstances and factors that determine such relations are not yet well understood, particularly in low-income countries. One of the purposes of the present paper is to assess the relationship between these production strategies and outputs indicators in Ethiopia. In this country, dairy cooperatives play an important role as possible milk marketing

channel for smallholders (though they are not available in the whole territory and face capital and other types of constraints). There is evidence showing that cooperatives can facilitate the intensification of production systems in developing countries, by means of facilitating access to inputs, knowledge transfer and the adoption of more productive technologies (Francesconi, 2009; Aneja, 1993; Getnet and Anullo, 2012; Odomenem and Obinne, 2010). However, there is yet not conclusive evidence about how cooperatives mediate on the relationship between different outputs of the production systems, neither on the relationship between these indicators and the economic performance of households. The present paper aims to contribute to fill such knowledge gap.

The remainder of this chapter is organized as follows. Section 3.2 is a short literature review about the factors that influence the performance of dairy production systems, especially in developing countries. Section 3.3 describes the study area and the methods used. Empirical results are presented in Section 3.4. We discuss the findings of our research and present some policy implications in Section 3.5.

3.2 Factors Influencing Dairy Production Performance

Milk is directly consumed in its raw state and it is also a crucial input in industrial use. Therefore, its properties (quality) usually play a critical role in the coordination of activities along the dairy value chain. For instance, milk that contains higher fat and protein content result in higher yield of butter and cheese (Draaiyer et al., 2009). Reflecting its complex composition, there are many possible indicators of milk quality. Lactose is the major carbohydrate constituent of milk (Gurr, 1985) and thus it might be used as an important quality indicator. The freezing point of milk is also often taken as a key indicator of quality since it is influenced by the level of milk adulteration (Navratilova et al., 2006). Harding (1999) highlights that milk freezing point offers the means of measuring and quantifying the amount of extraneous water in milk. This indicator is widely used in rejection tests. Using adulterated milk in processing will yield poor quality milk products with a short shelf-life.

In Ethiopia, according to SNV (2011), production of low quality milk can lead to great loss of milk and profits (e.g., when milk is rejected). Furthermore, milk quality and hygienic attributes are particularly important in less-developed countries, where diarrheal diseases kill approximately 1.8 million people annually, most of them children (Francesconi, 2009). Raw milk quality remains a key component in assessing the performance of dairy chains (Sraïri et al., 2008).

Due to the expected growth in income, increased urbanization, and improved policy environment, Ahmed et al. (2004) forecast that the dairy sector in Ethiopia will continue growing over the next one to two decades. Proper handling and quality management systems of milk can increase competitiveness of the dairy sector, the commercialization of milk and thereby helps to increase the income of value chain actors, including the upstream players (farmers). The expansion of the sector involves opportunities that farmers can embrace but also challenges related to the use of resources, such as capital and animal feed, as well as quality management systems. Processors and consumers are expected to increase their quality requirements across time. The relative importance of quality in the competitiveness of farmers is thus expected to rise. Milk quality can influence substantially the income of dairy farmers (Heinrichs et al., 2005).

Place et al. (2009) suggest that milk productivity, production and price in a given agro-ecological region are affected by many factors, such as animal breed, animal health, animal feed, markets for milk and dairy products, consumer awareness and demand, and overall policy regulation and support. Furthermore, collective organizations such as dairy cooperatives can also influence substantially dairy performance. For instance, Francesconi (2009) found out that cooperative membership positively influence production and productivity but has a negative impact on milk quality. This might probably be due to the fact that cooperative members usually have crossbreed cows with higher productivity but relatively lower fat and protein content; and non-members tend to have local breeds, for example Zebu (*Bos Indicus*), with lower milk quantities but higher fat and protein, as compared to crossbreed cattle.

A study conducted in Ethiopia by O'Mahony (1988) reports that fat, protein and lactose are influenced by the type of breed, dairy practices (interval between milking sessions feeding regime) as well as other factors such as the, stage of lactation, age of cow and the incidence of diseases. Yeamkong et al. (2010) report that in Central Thailand milk production per cow and milk quality traits (fat, lactose, solids not fat, total solids and somatic cell count) are significantly influenced by season, farm location, farm size and intrinsic characteristics of farmers (educational background, experience, training, social networks and economic resources). Millogo et al. (2008) show that the breed type has a significant impact on the productivity of dairy producers in Burkina Faso. However, it should be noted that without proper feed the improved breeds perform below their potential. A positive effect of experience on productivity has been reported in Zimbabwe by Chinogaramombe et al. (2008).

The freezing point is influenced by genetic factors (e.g. species and breed) and non-genetic factors, such as feed composition, water intake, milking time, milk yield, lactation stage, season of the year and herd size (Navratilova et al. 2006; Kedzierska-Matysel et al., 2011). This indicator is related to the content of milk constituents such as lactose, mineral salts, calcium ions, magnesium and phosphates (Raynal-Ljutovac et al., 2005).

Millogo et al. (2008) found that the use of concentrated feed, such as cottonseed cakes, increased significantly milk productivity. According to Ngongoni et al. (2006), concentrates supply energy and protein which increase milk production. However, there is evidence showing that a concentrate supplement raises milk yield and decreases milk fat and protein content (Hassan et al. 2011; Caja and Bocquier, 2000; Heinrichs et al., 2005). Feeding with concentrate may depress by its own action the fat and protein contents of milk as a result of acidosis, particularly if they are supplied in excess. In Ethiopia, farmers mainly depend on communal pastures and home produced supplements as feed for their dairy cattle. Homegrown options provide cheaper alternatives to concentrates, which are effective but costly (Place et al., 2009).

Another important determinant of milk quality is the distance from the cooperative headquarters. Francesconi (2006) argues that when farms are located close to the cooperative, the land

available for the herd is limited, reducing the quality of milk. This is because most cooperative headquarters are located in the proximity of urban areas, where land is relatively scarce, leading to a shortage of feed. Under such circumstances, farmers resort to backyard dairying. In addition to land scarcity and proximity to the cooperative, Firew (2007) points out that the seasonality and shortage of feed supply poses major nutritional stress on the cattle. This problem is more pronounced during the dry season, when the pastures are dry, inducing a serious feed shortage.

Several studies have been carried out to measure the quality of milk but very few studies — among them Yeamkong et al. (2010); Francesconi (2009) and Millogo et al. (2008) — go deeper into finding which factors influence the quality and productivity of milk. To our knowledge, no other study has assessed systematically the determinants of the chemical composition of milk in Ethiopia, as we have done. The factors that determine milk performance at the household level have not yet been fully and critically identified. There are only very few empirical studies (D'Haese et al. 2005; Francesconi, 2009) taking into consideration the role of institutions, such as cooperatives, in determining milk performance in Ethiopia. Our analytical framework is inspired by the one developed by Zuniga-Arias et al. (2008). We consider production factors and household socio-economic factors as possible determinants of milk performance. Figure 3.1 show the socio-economic and production factors that are likely to affect milk performance.

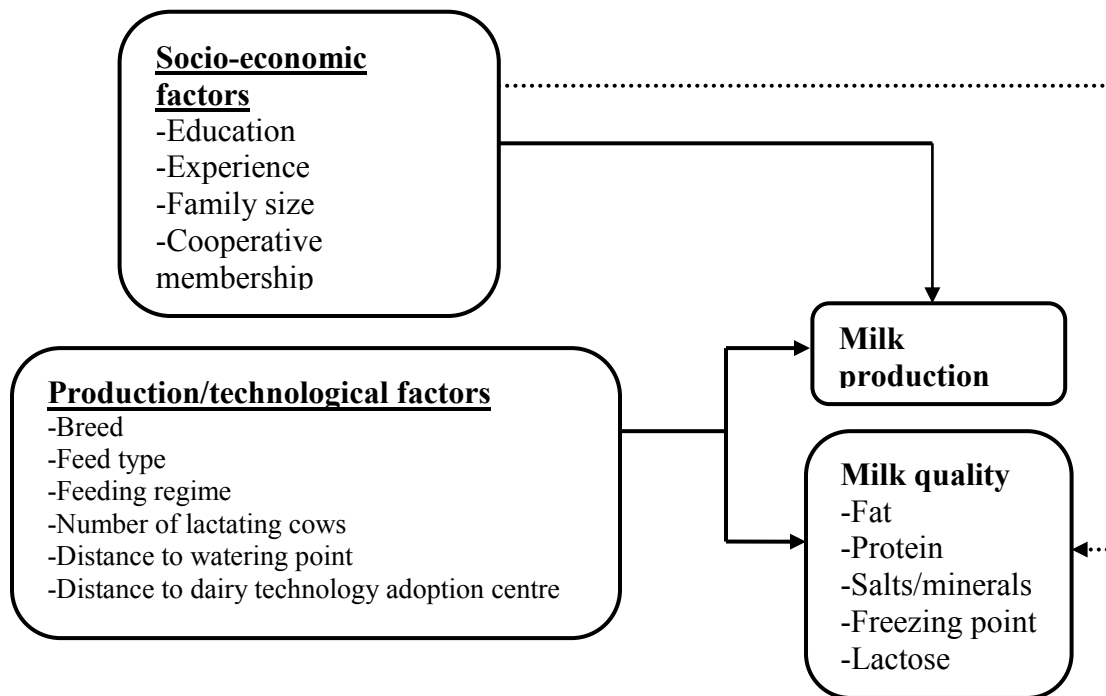


Figure 3.1 Analytical framework: Research model

3.3 Setting and methods

Study Area

Selale is a rural area located in Oromia Region; North Shoa Zone, Ethiopia. The farming community is engaged in mixed farming. Livestock raising and the production of dairy products are the main local sources of livelihood. Apart from dairying, landholders normally grow a variety of crops, including oats, teff, barley, wheat and peas. Selale area has a large potential for dairy development not only because of its proximity to Addis Abeba, but also due to a favorable situation in terms of natural feed supply, animal health and climatic suitability. The average annual temperature and rainfall ranges from 15 to 18°C and from 1000 to 1500 mm, respectively, and there are two annual rainy seasons: from February-May and from June-October (Tittarelli, (1990; Lobago et al. 2006).

The Milk Value Chain

Figure 3.2 depicts the dairy value chain in the study area. The main buyers in the study area are primary cooperatives and private traders. Private traders, such as Mama Milk, are licensed traders who own coolers and processing facilities. They collect and bulk milk from individual farmers (both non-members and members of cooperatives) and sell to retailers or wholesalers. There are also some traders who buy milk from farmers, bulk it and sell to processors. Primary cooperatives in the area buy milk from members and sell the bulked milk to the Selale Dairy Cooperative Union (SDCU). The union, in turn, transports the milk to processors, such as Shola Dairy Enterprise (a processing company in Addis Ababa). The union, in turn, transports the milk to processors, such as Shola Dairy Enterprise (a processing company in Addis Ababa).

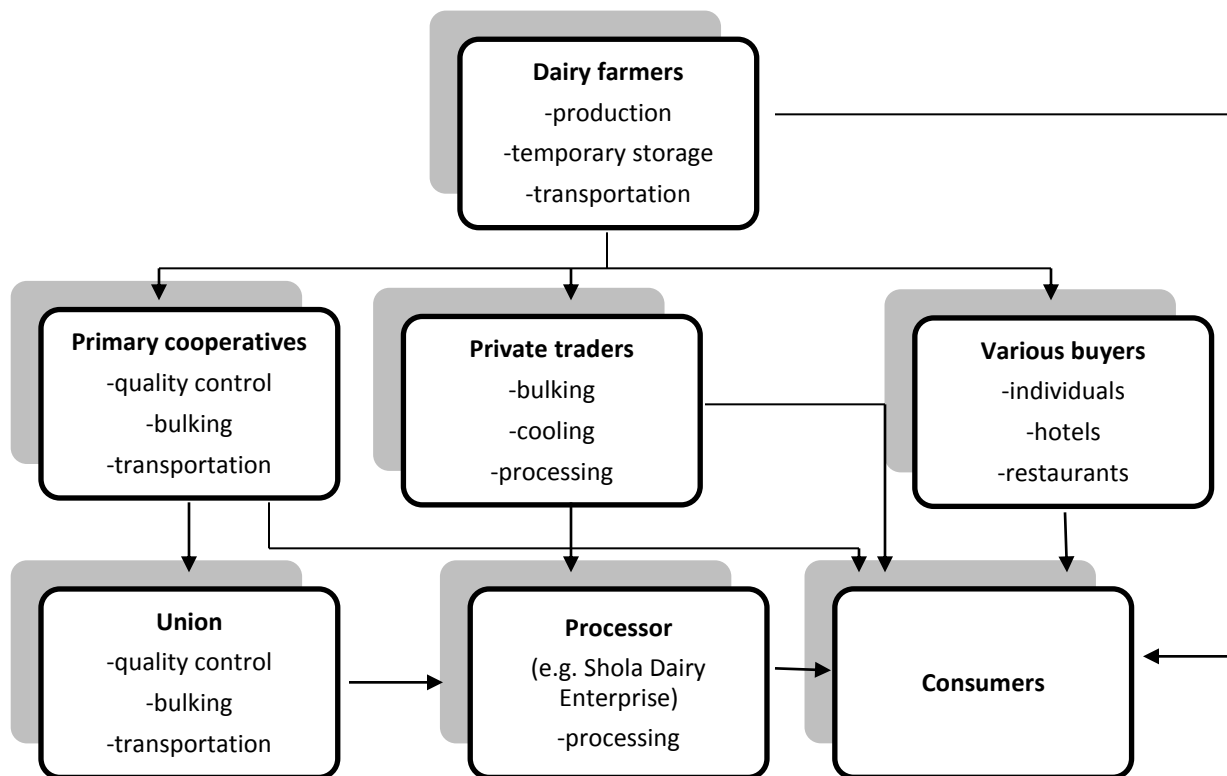


Figure 3.2 The milk value chain in Ethiopia

Sample

Data for this study were collected through a cross-section household survey administered to total sample of 384 households (192 cooperative members and 192 non-members). We randomly selected 5 cooperatives (Chanco, Lelistu, Nano Seyu, Debre Tsige and Torbanashe) out of the

24 primary cooperatives operating in the Selale area. Proportional random sampling was applied to select the members from these five primary cooperatives. Non-members were also selected randomly from the census of farmers kept by local authorities at the Kebele level (lowest administrative division in Ethiopia). Table 3.1 shows the total population for both members and non-members and the proportion of respondents selected for the survey.

Table 3.1 Total population and proportion of samples selected

Name of cooperative centre area	Total non-membership	Sample taken	Total membership	Sample taken
Chanco	815	50	50	28
Lelistu	546	34	38	21
Debre Tsige	357	22	121	66
Torbanashe	924	57	99	55
Nano Seyu	479	29	40	22
Total	3121	192	348	192

Structured questionnaires (pre-tested) were used for data collection. The data collected included households characteristics (age, sex, cooperative membership, etc) and features of the dairy production systems (breed of cow, feed type, feeding regime, total milk yield, number of cows, etc). In addition, with the assistance of the enumerators and governmental extension workers from the area samples of milk for physical-chemical analysis were collected from 374 interviewed households, at the farm level. Due to different reasons, we could not manage to obtain milk samples from the remaining 10 households. Milk samples were analyzed using a lacto-scan. Nine parameters were measured: fat content, protein content, salts, added water, milk temperature, freezing point, density, lactose and solids-non-fat (SNF).

Operational Definitions of Milk Indicators

Milk productivity was computed as the ratio between milk production (liters) and the number of milking cows available per farm. Milk production was estimated as the average quantity of milk

(liters) produced per farm on a daily basis. This figure excludes the milk directly consumed by the calves. We restricted milk quality indicators to the following ones: fat content, protein, lactose, minerals/salts and freezing point of the milk. As recommended by Miles and Huberman (1994), coding and entry took place simultaneously with data collection in order to identify potential sources of bias and incomplete data.

Statistical data analysis

The data was analyzed using the Statistical Package for Social Scientists (SPSS version 19). Data analysis was carried out using multiple regression analyses to determine the relationship between farm-level characteristics and milk performance. We use a number of milk performance indicators as our dependent variables. These include milk production, milk productivity and milk quality (fat content, protein, lactose, minerals/salts and freezing point). We used several (i) socio-economic; and (ii) production characteristics of the households as explanatory variables. To check for multicollinearity, we used the Variance Inflation Factor (VIF) and the Tolerance index. As a rule of thumb, there is a high level of multicollinearity if the Tolerance index is below 0.1 and the VIF of a variable is greater than 10 (Gujarati, 1995). To check for data normality, we used the numeric means and the Shapiro-Wilk and Kolmogorov-Smirnov tests. These goodness-of-fit tests assess whether the observations could reasonably have come from the specified distribution. If the value is below 0.05 we assumed that the data significantly deviate from a normal distribution.

Since the main objective of the current study is to identify factors that determine milk performance, it is therefore possible to fit a simple linear model of the form:

$$Y = f(X_1, X_2, X_3, X_4 \dots X_n) \quad (1)$$

Where Y denotes the dependent variables representing milk performance and the Xs denoted the explanatory variables.

The multiple regression equation we have adopted is the following:

$$Y_{ijklmno} = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + \dots + b_n X_n + \mathcal{E} \quad (2)$$

Where $Y_{ijklmno}$ = dependent variables (production, productivity, fat, protein, freezing point, lactose, salts/minerals), x = independent/explanatory variables; a = y intercept; b = slope of the line,
and \mathcal{E} = error term

3.4 Empirical results

Descriptive statistics

Some descriptive statistics on a number of variables between dairy cooperative members and non-members are presented in Table 3.2. Of the 384 households (192 members and 192 non-members) that were surveyed, the majority (73.7%) were male-headed. The study area is dominated by Orthodox Christians, who accounted for 99.7% of the surveyed households. Only 0.3% of the households were Protestant. The Orthodox Christians engage in three prolonged fasting (abstaining from any animal product and by-product) periods per year, and two fasting days every week (Wednesday and Friday), for a total of more than 200 days (Francesconi, 2009). None of the respondents were illiterate.

Table 3.2 Descriptive statistics

Variable	Members (192)		Non-members (192)	
	N	Frequency %	N	Frequency %
Gender: Male	138	71.9	145	75.5
Female	54	28.1	47	24.5
Education: Basic	78	40.6	120	62.5
Elementary	41	21.4	43	22.4
Junior	24	12.5	16	8.3
Secondary & above	49	25.5	13	6.8
Land ownership (Yes=1, No=0)	170	88.5	181	94.3
Marital Status: Married	158	82.3	162	84.4
Single	9	4.7	4	2.1
Divorced	7	3.6	9	4.7
Widowed	18	9.4	17	8.9
Reasons for raising cattle: Milk	191	99.5	191	99.5
Traction	104	54.2	161	83.9
Manure	100	52.1	144	75
Meat production	55	28.6	78	40.6
Cow dung	17	8.9	14	7.3
Income	21	10.9	13	6.8
Crop production activities (Yes=1, No=0)	115	59.9	159	82.8

Three types of feeding regimes exist in the area: free grazing, stall-feeding and rotational grazing. Free grazing means that animals are free to graze on natural and communal pastures. Usually these natural and unimproved pastures are neither quantitatively nor qualitatively adequate to support profitable dairy production. Stall-feeding entails providing concentrated feed such as wheat bran and oil seed cakes to the cows, as well as the supply of feed supplements such as crop residues of wheat or teff. In the rotational grazing system, animals graze in treated

or managed pastures on a rotational basis. In the study area, we found that the households practice either only one or a combination feeding regimes. We found that 26% of the households practice only free grazing and 24% are using only stall feeding (zero grazing). None of the households depended only on rotational grazing. 29% of the households have adopted a combination of stall-feeding and free grazing, while 9% practice both free and rotational grazing. 11% are engaged in a combination of all the three practices. Farmers in the study area use different kinds of feed for their cows. Table 3.3 shows the different feed types applied by the dairying households.

Table 3.3 Feed types utilized by respondents in the study area

Feed type	Member (192)		Non-member (192)	
	N	Frequency %	N	Frequency %
Crop residue	161	83.9	186	96.9
Hay	189	98.4	182	94.8
Green grass	22	11.5	26	13.5
Forage	2	1	2	1
Beer preparation residue	55	28.6	48	25
Areki (ethanol)	40	20.8	38	19.8
Oil seed cakes	144	75	101	52.6
Wheat bran	103	53.6	60	31.3
Wheat middling	2	1	2	1
Molasses	38	19.8	17	8.9
Mineral blocks	24	12.5	21	10.9
Chemical treated straws	1	0.5	1	0.5
Concentrate	55	28.6	18	9.4

Hay (grass that is cut and dried for livestock fodder) is the most used type of feed, followed by the crop residues. The use concentrate feed such as oil seed cakes and wheat bran was high amongst cooperative members. Different types of animal houses exist in the area. 39% of households shelter their local and crossbreed cows in dairy barns. 23% of the respondents keep their cows in traditional huts, whereas 20% keep their cows in an open area with enclosure. Most of the barns are constructed within the living compound of the households and thus they are small and crowded. While local breeds tend to be allowed to graze in open pastures, the crossbreeds are rather kept most of the time in such crowded barns.

We performed a t-test analysis for assessing differences in the dependent variables and some explanatory variables between cooperative members and non-members. Table 4 summarizes the differences between these two groups. Cooperative members hold significant higher milk production and productivity. Non-members produce milk with higher fat content as compared to cooperative members. The milk freezing point was significantly lower among non-members. However, we did not find significant differences between members and non-members with regards to protein, salts/minerals and lactose content of the milk.

Table 3.4 Comparisons between dairy farmers who are members and non-members of cooperatives

Variable	N (member)	Members (192)		N (non-member)	Non-members (192)		Differences	
		Mean	SD		Mean	SD	T-stat	P-value
Dependent Variables								
Milk production (liters)	190	20.12	18.61	183	7.53	6.60	8.770	0.000***
Milk productivity (liters/cow)	190	8.33	4.93	183	4.34	2.99	9.466	0.000***
Fat (%)	187	4.65	1.63	187	5.30	1.77	-3.693	0.000***
Protein (%)	187	3.01	0.19	187	3.02	0.22	-0.517	0.606
Freezing point (°C)	187	0.528	0.04	187	0.539	0.04	-1.810	0.071*
Salts/minerals (%)	187	0.67	0.05	187	0.67	0.05	-0.085	0.932
Lactose (%)	187	4.53	0.29	187	4.53	0.34	-0.038	0.970
Independent Variables								
Age	192	48.67	13.71	192	45.55	14.79	2.144	0.033**
Sex (dummy)	192	0.72	0.45	192	0.76	0.43	-0.810	0.418

Family size	192	6.60	2.64	192	5.79	2.33	3.198	0.002**
Years of dairying experience	192	21.44	11.57	192	22.09	14.37	-0.489	0.625
Own land (dummy, 1=yes, 0=no)	192	0.89	0.32	192	0.94	0.23	-2.008	0.045**
Total number of livestock owned	192	17.80	12.66	192	15.76	10.12	1.745	0.082*
Number of lactating cows	192	2.48	1.78	192	1.85	1.24	4.019	0.000***
Distance to watering point	192	0.21	0.23	192	0.31	0.24	-4.052	0.000***
Access to credit (dummy, 1=yes, 0=no)	192	1.06	0.233	192	1.03	0.174	1.240	0.216
Distance to dairy technology center	192	4.45	5.48	192	5.94	5.43	-2.671	0.008**
Cattle died on the farm in 2011	192	0.66	1.547	192	0.91	2.885	-1.058	0.291
Proportion of milk used for processing	190	0.064	0.187	181	0.467	0.431	-11.601	0.000***
Average price per liter of milk (Birr)	181	5.413	0.235	89	5.347	0.300	1.818	0.071*
Price per kilo of butter (Birr)	50	67.38	41.423	109	80.32	27.439	-2.016	0.048**
Distance from market or collection centre (km)	192	1.06	0.263	178	1.24	0.464	-4.377	0.000***

SD = Standard Deviation

Regression results

A number of regressions were carried out to assess the factors that determine milk production, productivity and milk quality (fat, protein, freezing point, salts/minerals and lactose). Factors affecting milk production and productivity are presented in Tables 3.5 and 3.6 respectively. Variables influencing milk quality/ composition are presented in Table 3.7.

Table 3.5 Factors affecting milk production

Model	B	Std. Error	Sig.
(Constant)	-2.042	5.196	
<i>Organizational characteristics</i>			
Membership status	2.297	1.144	**
<i>Individual characteristics</i>			
Family size	0.280	0.200	
Level of education	1.736	0.490	***
Land ownership	2.787	1.810	
<i>Technological/management characteristics</i>			
Frequency of watering animals	0.943	1.175	
Proportion of crossbreed cows to total of lactating cows	3.110	1.267	**
Distance of farm from dairy technology adoption centre ^{a)}	-0.063	.0.108	
Wheat bran	0.007	0.003	**
Concentrate	-0.001	0.002	
Green grass	.0,019	0.007	**
Wheat middling	-0.007	0.005	
Distance to watering point	-6.122	2.339	**
Free grazing and Stall feeding	.0,808	1.218	
Mineral blocks	-0.070	0.073	
Number of lactating cows	5.385	0.346	***
Veterinary drugs bought for dairy cows	0.047	0.010	***
Free grazing	-9.325	1.694	***

<i>Economic characteristics</i>			
Credit access	-3.299	2.469	

Note a) Dairy technology adoption centre is defined as a centre where farmers can get services such as veterinary, artificial insemination (AI), pregnant cows, bull services, agro-industrial by-products, for example wheat bran.

Dependent Variable: Total milk produced per day (liters)

Adj. $R^2 = 0.64$; *** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$; NS = not significant

The results of the model indicate that milk production is positively related to membership status, education level, the proportion of crossbreed cows among lactating cows, number of lactating cows, the use of wheat bran and green grass feed, and the amount spent in buying veterinary drugs. Distance to watering point as well as free grazing influence milk production negatively.

Table 3.6 Factors affecting milk productivity

Model	B	Std. Error	Sign.
(Constant)	3.539	1.672	**
<i>Organizational characteristics</i>			
Membership status	1.217	.368	**
<i>Individual characteristics</i>			
Total family size	.120	.064	*
Level of education	.615	.158	***
<i>Economic characteristics</i>			
Credit access	.145	.794	
<i>Technological/managerial characteristics</i>			
Distance to watering point	-1.120	.752	
Free grazing and Stall feeding	1.144	.392	**
Land ownership	1.411	.582	**
Proportion of crossbreed cows to the total lactating cows	1.599	.408	***
Frequency of watering animals	.453	.378	

Distance of farm from dairy technology adoption centre	-.042	.035	
Mineral blocks	.033	.023	
Number of lactating cows	-.344	.111	**
Veterinary	.011	.003	**
Wheat bran	.004	.001	***
Concentrate	.000	.001	
Green grass	.004	.002	*
Wheat middling	-.004	.002	
Free grazing	-4.655	.545	***

Dependent Variable: Milk productivity

Adj. $R^2 = 0.58$

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$; NS = not significant

The results show that membership status, level of education, land ownership, total family size, a combination of free grazing and stall feeding, the proportion of crossbreed cows among lactating cows, the use of wheat bran and green grass as animal feed and the amount spent in buying veterinary drugs are positively related to milk productivity. Only free grazing and the number of lactating cows are negatively and significantly related to milk productivity. Some of the variables that facilitate higher milk yield are negatively related to some indicators of milk quality, as we will see below. This result is consistent with the hypothesis of a trade-off between milk quantity and quality.

Table 3.7 Factors affecting milk quality components (OLS)

Variable	Fat	Protein	Freezing point	Salts/Minerals	Lactose
	B coefficient	B coefficient	B coefficient	B coefficient	B coefficient
(Constant)	4.982 (.559)***	3.033 (.169)***	.532 (.032)***	.649 (.040)***	4.336 (.256)***
Organizational characteristics					
Membership status	-.446 (.191)**	.023 (.042)	.002 (.008)	-.001 (.010)	-.010 (.066)
Individual characteristics					
Land ownership	.631 (.323)*	n.i	n.i	n.i	n.i
Technological/managerial characteristics					
Free grazing and stall feeding	.382 (.205)*	-.001 (.048)	.004 (.009)	n.i	n.i
Frequency of watering animals	n.i	-.086 (.052)	-.014 (.010)	-.013 (.012)	-.081 (.076)
Distance to water point	.563 (.373)	n.i	n.i	n.i	n.i
Proportion crossbreed cows to lactating cows	-.110 (.217)	-.116 (.059)*	-.004 (.011)	-.026 (.014)*	-.143 (.091)
Wheat bran	-.001 (.001)**	.000 (.000)**	.000 (.000)***	-7.701E-5(.000)**	.000 (.000)**
Concentrate	-.001 (.000)**	n.i	n.i	n.i	n.i
Mineral blocks	-.012 (.013)	n.i	n.i	.001 (.001)	.006 (.004)
Mastitis	n.i	-.002 (.045)	.010 (.009)	-.001 (.010)	-.049 (.066)
Forage	n.i	.253 (.101)**	.038 (.019)*	.056 (.023)**	.368 (.147)**
Animal health	.022 (.039)	n.i	n.i	.003 (.002)	.012 (.015)
Presence of barn for local breed	n.i	.267 (.069)**	.011 (.005)**	.011 (.006)*	.069 (.038)*
Presence of barn for crossbreeds	n.i	-.006 (.026)	-.001 (.005)	.002 (.006)	.022 (.039)
Disease with respiratory problems	-.312 (.253)	n.i	n.i	n.i	n.i
Green grass	.002 (.001)*	n.i	n.i	n.i	n.i
Wheat middling	.001 (.001)	n.i	n.i	n.i	n.i
Free, stall and rotational	.743 (.363)**	-.171 (.067)**	-.039 (.013)**	-.055 (.015)***	-.336 (.096)**
Molasses	.006 (.008)	n.i	n.i	n.i	n.i
Crop cultivation	n.i	.267 (.069)***	.043 (.013)**	.061 (.016)***	.402 (.103)***
Economic characteristics					
Milk production	n.i	n.i	n.i	.000 (.000)	.003 (.003)
Credit access	-.438 (.418)	n.i	n.i	n.i	n.i
Adj.R ²	0.10	0.18	0.17	0.21	0.21

Note: Standard error in parentheses (), n.i. = indicate variables not included in the analysis, *** P<0.01, ** P<0.05, * P<0.10

The fat content of milk is positively influenced by green grass feed, land ownership, the combination of free grazing and stalls feeding; and the combination of free, stall and rotational grazing. We also found that membership status, the use wheat bran and concentrated feed negatively and significantly influence the fat content of milk. The protein content is positively and significantly influenced by the use of wheat bran and forage as feed, crop cultivation activities and the presence of barns for local breeds. The proportion of crossbreeds among lactating cows and a combination of free, stall and rotational grazing negatively influence protein content. The freezing point of milk is positively and significantly influenced by the use of wheat bran and forage as feed, as well as by the presence of barns to shelter local cows and the cultivation of crops. We found that a combination of free, stall and rotational grazing negatively influence the freezing point.

The salts or mineral composition of milk is positively affected by the use of forage feed, crop cultivation and the presence of barns for local breeds. A combination of free, stall and rotational grazing, wheat bran feed and the proportion of crossbreed cows to the total number of lactating cows negatively influence the salts or mineral composition of milk. Lactose composition of the milk is positively affected by crop cultivation, forage and wheat bran feed, and the presence of barns for local breeds. We found a negative influence of the combination of free, stall and rotational grazing on the lactose content of milk.

To summarize our findings, breed type, feed type, type of shelter, feeding regime, family size and cooperative membership have a significant influence on milk production and productivity. The same variables affect milk quality, with some differences only in the direction of the effect, i.e. either positive or negative. These results suggest that milk productivity is higher under the intensive production systems owing to the higher use of technology such as crossbreed cows and agro-industrial feed. As well, our results indicate that there is a trade-off between higher production and quality of milk. Put differently, the factors (e.g. breed, feed type) that increase milk production and productivity often decrease milk quality components.

3.5 Discussion and policy implications

Our results reveal that cooperative members have higher milk production and productivity but lower fat content, confirming the findings of Francesconi (2009) and Francesconi and Ruben (2012). A likely explanation for this effect is that the majority of cooperative members own crossbreed cows with high milk yielding capacities as compared to the indigenous zebu breed. The adoption of crossbreed cows is promoted by the cooperatives, owing to their higher milk production potential. Members have access to a number of services offered by the cooperative, including trainings and the technical know-how for the enhancement of productivity. Members can easily acquire crossbreed cows and other dairy inputs through their cooperatives on a credit basis. For instance, the cooperative union (to which the primary cooperatives belong) can give credit to the members which are repayable within 2 to 3 years. In addition, governmental and non-governmental organizations promoting dairy development target farmer groups such as cooperatives in their interventions, thus facilitating access to technology and know-how among cooperative members.

We found that the freezing point of milk produced by non-members is lower. Cooperative members have an average freezing point that is internationally regarded as the maximum acceptable value. Navrátilová et al. (2006) indicate that for freezing point values between -0.530 and -0.534°C milk production checks are needed to identify the possible source of the extraneous water. However, as explained above, water addition is not the only explanation for variations in the freezing point. The higher freezing point amongst members might be explained by the breed type. Crossbreed cows are characterized by lower concentrations of fat and protein and thus their milk is more diluted, leading to higher freezing point. Indigenous breeds produce milk with higher concentrations of fat, protein and lactose, which depresses the freezing point. Empirical evidence from Poland (Kedzierska-Matysek et al., 2011) shows that the breed of cow, among other variables, significantly influence the freezing point of milk. However, caution should be taken when interpreting the results of this particular quality indicator since a high variability in maximum values of freezing point has been reported (Navratilova et al., 2006; Kedzierska-Matysek et al., 2011).

We have also found that crossbreed cows have a significant and negative influence on protein content. As stated above, the dairy herd among non-members is dominated by local breeds with higher concentrations of milk nutrients (fat and protein). The non-members consider the higher fat content of their milk from local cows as an important quality attribute they possess. However, the pricing strategy of buyers does not acknowledge such attributes. In collection centers, acceptance of milk is conditional only to alcohol and specific gravity tests. Given these market conditions, non-members often adopt the strategy to process their milk and obtain higher quantities of butter and cheese rather than selling it as raw milk. Our data (see Table 3.6) show that non-members process 46.7% of their total milk production whereas cooperative members process only 6.4% of their total production. As shown in Table 3.6, non-members also obtain significant higher prices for the butter they produce.

Our analysis reveals that the breed of cow significantly and negatively influences the mineral composition of milk, and confirms the findings of Gabris and Bajan (1983), who report that milk of less productive cows (zebu in our case) have a higher content of sodium and magnesium, as compared with the milk of higher-yielding cows. It is worth noting that the mineral composition together with other milk quality components such as lactose, fat and protein directly influences the freezing point of milk. In general, as stated above, the higher the mineral composition, the lower the freezing point of milk.

Our results show that more educated farmers hold both higher milk production and milk productivity. This finding is in line with the results of Yeamkong et al. (2010), who found that monthly milk production and revenue per farm and per cow increased with the level of education of farmers in Thailand. A possible explanation could be that more educated farmers have more access to and are more willing to try out new technologies that boost their milk performance. Yeamkong et al. (2010) also suggest that farmers with higher educational level may be more able to access and understand information and technology, and to properly apply them. We also found that family size and land ownership have a significant and positive influence on milk productivity. Family members provide labor for conducting dairy activities. Ozcatalbas et al. (2010) also report that family size is positively associated with milk yield. However, contrary to

our findings, D'Haese et al. (2005) did not find any significant effect of family size on milk productivity. Furthermore, according to our results, another determinant of dairy productivity is land ownership. If the farmer owns the land, he/she may feel less uncertainty to make on farm investments that will help to enhance productivity. Land shortage is a salient issue in the study area and in Ethiopia in general. The farmers mentioned lack of land as one of the main constraints in dairy production in the area.

According to our results, nutritional management (feed) is another factor influencing milk performance. On the one hand, milk production and productivity are positively related to the amount of supply of concentrated feed, such as wheat bran. On the other hand, there is a negative relationship between the amount of concentrate supplements and fat content, reflected also in higher freezing point of milk. Caja and Bocquier (2000) also report that excessive feeding with concentrate may depress by its own action the fat and protein contents as a result of acidosis. Acidosis is a metabolic disorder (Schwartzkopf-Genswein et al., 2003) that develops when the cow is fed with concentrates but it does not consume sufficient fiber for stimulating adequate chewing and salivary secretion to balance the acids produced during fermentation. This condition causes discomfort to the cow, and therefore reduces feed intake.

Our findings also reveal that free grazing negatively influences both milk production and productivity. The dominant feed resource for cattle in Selale is natural pasture from communal grazing lands (SNV, 2011). Topps and Oliver (1993) point out that unless supplemented with a protein concentrate, cattle grazing natural pasture tend to lose body weight, which leads to lower yields and productivity. In addition, Walshe et al. (1991) argue that natural pasture is not nutritious enough and would rarely support milk yields over 3 or 4 kgs per cow per day. In the same line, Mesfin et al. (2009) highlight that fibrous crop residues and natural pastures in the dry season have low nutritive value. In addition, the grazing land in the study area is communal and there is no proper management and control over livestock numbers, which contributes to depress productivity. Hence Bebe et al. (2003) highlight that zero-grazing (stall-feeding) which increases productivity is the common strategy of intensifying dairy particularly among smallholders in the densely populated highlands.

A combination of either both free grazing and stall-feeding, or stall-feeding and rotational grazing has a positive effect on milk production and productivity. These feeding regimes also increase fat content. Thus, through free grazing alongside supplements of concentrates, dairy farmers can achieve higher volumes of milk and better milk quality. However, we found that the triple combination of free grazing, stall-feeding and rotational grazing affects negatively the protein, salts, lactose and freezing point. Again, this indicates a trade-off between milk quantity and quality. A possible explanation for this effect is that in such a feeding regime cows are fed with protein-rich diets, which may depress the nutrient components of milk

As expected, our results indicate that the number of cows and milk production are positively related. However, the opposite holds for milk productivity. We found a negative relationship between the number of lactating cows and productivity. This might be due to the pressure exerted on feed resources by a larger number of cows and also due to less attention/care given to each cow in larger herds. This result suggests that there is an optimal number of cows, after which productivity tends to decrease. D'Haese et al. (2005) also found that the number of cows was negatively related to productivity in Ethiopia. In a similar vein, Schreiber (2002) reports that reducing stocks resulted in further specialization in milk production in Kenya. Households in the study area repeatedly mentioned having many cows as a major constraint faced in dairy production. When asked what could be done to ease pressure on feed and water resources, several farmers proposed reducing the size of the dairy herd as a possible solution.

Shelter management is an additional factor affecting the productivity of dairy cows. Shelter affects the feeding habits of an animal, thus influencing the milk composition. Our results indicate that the presence of barns for local breeds increases the concentration of nutrients in milk (protein, freezing point, salts and lactose). However, the presence of barns for crossbreed cows did not have a significant effect on the content of milk nutrients. Our results suggest that the type of barns used to keep the crossbreed cows do not seem very suitable. Barns conditions are particularly important in the case of crossbreed cows, since in the study area they are kept most of the time indoors, where they are stall-fed. According to Henrichs et al. (2005), poor ventilation or lack of cow comfort can depress milk fat and protein production by reducing feed

intake. Feeding space is always limited in the crowded barns. This causes the cows to spend more time standing, waiting to get access to the feed, and probably the time spent lying is less than the recommended 12–13 h/day (O'Driscoll et al., 2009). The benefits of lying have been reported in the literature. This behavior is associated with a reduction in lameness. Furthermore, it increases blood flow to the udder, reduces health costs, increases productivity and improves the well-being of dairy cows (Botheras, 2007; O'Driscoll et al., 2009). In our case, some farmers reported that they could allow their crossbreed cows to graze around their premises for an hour or so. However, given the serious land shortage in the study area, this option is not always available. The results reported above indicate that improvements need to be done in the management of shelter for the crossbreed cows.

We found that the distance to the watering point negatively influences milk production. In the study area, the majority of households obtain water from rivers, which are often located far from the farms. Long distances to the watering points stress the animals and reduce the frequency at which animals are watered. Moreover, dairy cows lose energy by travelling to and from distant water sources, thereby reducing productivity. Pedersen and Madsen (1998) reveal that lack of (fresh) water for cattle limits feed intake, thus reducing production. Several authors (Amaral-Phillips 2010; Beede, 1993; Grant, 1993) have identified water as most important input for the maintenance and productivity of dairy cattle. Lukuyu et al. (2007) also report that a milking cow needs about five liters of water to produce a liter of milk. Hence, Amaral-Phillips (2010) state that limitations in the availability of clean, fresh, and high-quality water can affect milk production in a more significant way than any other input. A detailed discussion on the importance of water for dairy cows can be found in Grant (1993). The respondents reported lack of (fresh) water as one of the constraints they face in dairy production in the area.

Milk performance has profound implications for the safety of the consumers and the welfare of farmers. The expected rise of demand for milk and milk derivatives is a matter of concern in Ethiopia. Higher volumes of milk with good quality need to be produced in order to meet this demand. It is therefore important to identify the factors that determine milk performance. Our results show that breed type, feed type, feeding regime, the level of education, cooperative

membership and the number of lactating cows are very important factors influencing milk performance. We also found that cooperatives are playing an important role in the development of the dairy sector in the study area, by means of facilitating the adoption of intensified modes of production. However, currently such intensification seems to be occurring at the expense of some quality indicators. There is therefore scope for improvement. First, the levels of protein and fat content of crossbreed cows can be increased by means of a better management the feeding system, and in particular a combination of either free grazing and stall-feeding or stall-feeding and rotational grazing. Secondly, as stated above, the current barns for crossbreed cows do not seem very appropriate. A training program of cooperatives members on these two critical issues will likely render significant results in reconciling different performance indicators.

Quality concerns do not end at the farm level, but they have to be addressed along the milk value chain. Hence, further research along other points of the value chain (for example at cooperative or processor level) must be conducted in order to identify additional determinants of milk performance. Since quality has different meanings for different stakeholders along the value chain, it is necessary to carry out research dealing with perceptions by different stakeholders, such as processors and consumers, in order to understand their quality preferences, and to assess to what extent they are aligned with those of farmers. By so doing we will be able to integrate the activities of the production side (dairy producers) with the requirements or preferences of the consumption side (processors/consumers).

CHAPTER 4. Cooperative Membership and Dairy Performance among Smallholders in Ethiopia⁸

Abstract

This study assesses the impact of cooperative membership among dairy producers in Selale, Ethiopia. We selected eight impact indicators: proportion of dairy income to total household income, total dairy income, technological innovation (proportion of crossbreed cows to the total number of cows in the herd), milk production, milk productivity, commercialization, income per liter and the share of milk production that is processed at the household level. In order to minimize the biases that may arise by simply comparing members and non-members, we employed a propensity scores matching technique. The empirical analysis shows a significant impact of cooperative membership along all impact indicators, except price. The findings also suggest structural trade-offs between different domains of cooperatives' action.

Key words: Cooperatives; Dairy producers; Propensity scores matching; Income; Technological innovation, Ethiopia

⁸ This chapter is based on the paper which is submitted to the Food Policy Journal for possible publication.

4.1 Introduction

Increasing population, urbanization, and the rise in consumers' income is expected to increase the demand for milk and milk products in Ethiopia, since they constitute an important part of the Ethiopian diet. Ethiopia has the largest cattle population in Africa and milk production is by far dominated by small-scale landholders. Such conditions create opportunities for achieving a higher level of market integration by small farmers, particularly for serving urban consumers, which could induce significant improvement in rural income. Several governmental policies and interventions by the international cooperation have been put in place recently aiming to foster the development of the incipient modern dairy value chain (which involves processing and pasteurization) supplying the growing urban market in Ethiopia. It is worth noting that currently most consumers in Ethiopia still buy raw milk (which is most of the time later boiled at home).

When integrating into markets, small-scale agricultural producers face a wide range of challenges, most of them related to transaction costs. This includes transportation costs, the cost of accessing high quality services, technology and inputs, the costs of meeting standards, and more in general the costs associated with coordinating product attributes and delivery conditions along the value chain (Kydd and Dorward, 2004). Due to these structural constraints, the incidence of transaction costs tends to be particularly high among small-scale agricultural producers. Producers' organizations can play an important role in reducing such costs, and therefore in facilitating market integration (Staal et al., 1997). The role of producers' organizations in reducing transaction costs and facilitating market integration of small-scale farmers is expected to be particularly important in the dairy sector. Dairy production is a risky venture, with potential high transaction costs arising from the perishable nature of the product as well as from the uncertainty in market availability, price fluctuations and seasonal demand of milk. Furthermore, uncertainties related to demand and spoilages are particularly high in Ethiopia, in part due to the fact that practicing Orthodox Christians fast for long periods of time (up to about 200 days per annum) during which they refrain from consuming products derived from livestock, including dairy products (Tefera et al., 2010). During prolonged fasting periods, demand and prices are depressed. In addition, the adoption of cooling transportation for milk is

still in an early stage of development in Ethiopia, which increases substantially the risks of milk spoilage.

By means of providing bulking and bargaining services, cooperatives may enhance market access and help farmers avoid the hazards associated with a perishable product with uncertain and variable demand. By means of pooling supply purchases and sales, dairy marketing cooperatives can contribute to decrease transaction costs, price risks and enhance bargaining power of dairy producers (Holloway et al., 1999). Cooperatives can serve as a vehicle for the dissemination of dairy technologies and to gain access to a range of benefits derived from the action of agents outside the value chain, such as government subsidies, donor funds and outputs of research and development. In addition, many donor and non-governmental organizations organize their rural development and poverty reduction interventions through cooperatives and other farmers' organizations (Bernard and Spielman, 2009). In Ethiopia, the government has stressed the importance of cooperatives as vehicle to improve commercialization and to alleviate poverty amongst the resource-poor farmers (Getnet and Anullo, 2012) and these organizations have been targeted as key institutions in national plans to foster rural economic development.

Despite their many potential advantages, cooperatives however are prone to suffer a number of important challenges, such as free-riding, corruption, principal-agent problems or different sorts of mismatches between the individual and collective interests (Ortmann and King, 2007). In Ethiopia, cooperatives suffer from low managerial capacity, difficulties in accessing working capital, free-riding behavior by farmers and other major constraints that hamper their performance. The development impacts of cooperatives depend on their capacity to deliver good quality services, and therefore to cope with the problems just mentioned. Such impacts hence cannot be taken for granted and they are determined by the ability of cooperatives to surmount their structural and contextual problems. In order to assess the development impacts of dairy cooperatives in rural areas (the extent to which they are contributing to facilitate market integration and the economic development of small-scale producers) we need to examine two key aspects: (i) who are the members of cooperatives (what type of farmers benefit from their services) and (ii) how is the performance of such members, in comparison to non-members,

influenced by the services provided by the cooperative. That is, we need to assess to what extent and how members benefit from cooperative services. The combination of these different issues will enable us not only to evaluate the effects of membership, but also to shed some light about the mechanisms through which such effects take place.

The main objective of the present study is to identify the determinants and impacts of cooperative membership among small-scale dairy producers in Ethiopia, and thus to contribute to assess to what extent and how producers' organizations can be catalyst of rural economic development. For doing so, we compare the performance of cooperative members with otherwise similar non-members dairy farmers, controlling for biases using matching techniques. More specifically, in this chapter we address the following two main research questions: (i) What are the factors determining the probability of cooperative membership? and (ii) What are the main impacts at the household level of cooperative membership among dairy producers in Ethiopia?

The remaining part of this chapter is structured as follows: Section 4.2 provides some working hypotheses about determinants of membership and the impact of cooperative membership. We present the methodology we have followed in section 4.3, including the sampling procedure, the variables considered and the econometric techniques we used. Our empirical results are presented in section 4.4. Finally, we discuss our findings and present some policy implications in Section 4.5.

4.2 Determinants and impacts of cooperative membership

Agricultural cooperatives are very diverse, in terms of specialization, services delivered and internal governance. Generalizations about their membership composition and impacts are therefore difficult to draw. Even within Ethiopia, there are significant differences between the cooperatives with regards to service delivery, market orientation, composition and socio-economic context. All these variables influence the level of market integration of their members (Francesconi and Heerink, 2010). In addition, rigorous empirical evidence (systematic comparisons between members and non-members that control for biases) about the impacts of

cooperative membership is rather scarce. Some examples of systematic comparisons include the work conducted by Bernard et al. (2008a), who found that grain cooperatives in Ethiopia enhanced market commercialization among members with relatively larger land size, while reduced the level of commercialization among farmers with smaller land sizes. They found that the overall effect of membership on commercialization is not significant. This occurs in spite of the finding that all types of cooperative members receive higher average prices (in comparison with non-members). Francesconi and Heerink (2010) show additional evidence for explaining these effects not only as differentiated impacts depending on land size, but also on the type of cooperative organization the farmers belong. They distinguish between “marketing” and “livelihoods” cooperatives. The latter are specialized in the provision of public goods, and induce no significant effects on the level of market integration among the members. After analyzing the effects of farmers’ organizations in Senegal and Burkina Faso, Bernard et al. (2008b) also conclude that the delivery of public goods by a market-oriented organization is associated with lower marketing performance. They state that such result is the consequence of a compromise between equity (solidarity) and efficiency.

Wollini and Zeller (2007) report higher average prices among coffee growers in Costa Rica who are members of marketing cooperatives (in comparison with their non-member peers). They also conclude that members have more chances to be engaged in specialty markets. However, Fischer and Qaim (2012) found significant income effects of cooperative membership among banana growers in Tanzania, but not significant price effect. These authors also investigated the determinants of cooperative membership. In line with the findings of Bernard and Spielman (2009), they report that the likelihood of membership increases with land size until a threshold level, after which there is a negative relationship between both variables. This pattern has been coined by these authors as “the middle class effect”.

Studying the effects of cooperative membership among dairy producers in Ethiopia (in a different location to ours and using a smaller sample size and number of milk quality indicators), Francesconi and Ruben (2012) report a positive effect on milk production and productivity, and a negative effect on fat and protein content. Getnet and Anullo (2010) show a positive effect of

cooperative membership on total income and savings, among farmers of the Sidama region, in Ethiopia. However, no significant effects of membership were found for assets. Abebaw and Haile (2013) found that cooperative membership in Ethiopia has a positive relationship with the level of use of fertilizers, which might be explained by the fact that cooperatives in Ethiopia have a monopoly in the supply of (subsidized) fertilizers (being the private market for fertilizers still absent).

Based on the evidence summarized above, we can advance two working hypotheses about the determinants of membership and the impacts of cooperatives, and more specifically of dairy cooperatives in developing countries. First, in line with the proposition of Bernard and Spielman (2009), the poorest of the poor are not well represented in agricultural cooperatives. Instead, these organizations tend to be composed mainly with farmers with an intermediate level of assets (land, technology, education, etc.). Secondly, the effects of membership seem to be characterized by compromises between different functions (e.g. price vs commercialization; provision of public goods vs marketing, etc.), at least at early stages of cooperative development. Here we test empirically whether these hypotheses hold for our case study (among small-scale dairy producers in Selale area, Ethiopia). The following section describes the study area, as well as the methods we have followed for primary data collection and analysis.

4.3 Methodology

Description of the study area

The study was carried out in Selale (Oromia region), one of the main dairy producing areas in Ethiopia. In this location (see Figure 1), about 85% of the population is agrarian. Local livelihoods are mainly dependent on livestock raising and dairy production. Major crops locally grown include oats, teff, barley, wheat, horse beans and field peas. The topography of the area provides a suitable microclimate for the introduction of high-yielding dairy cows.

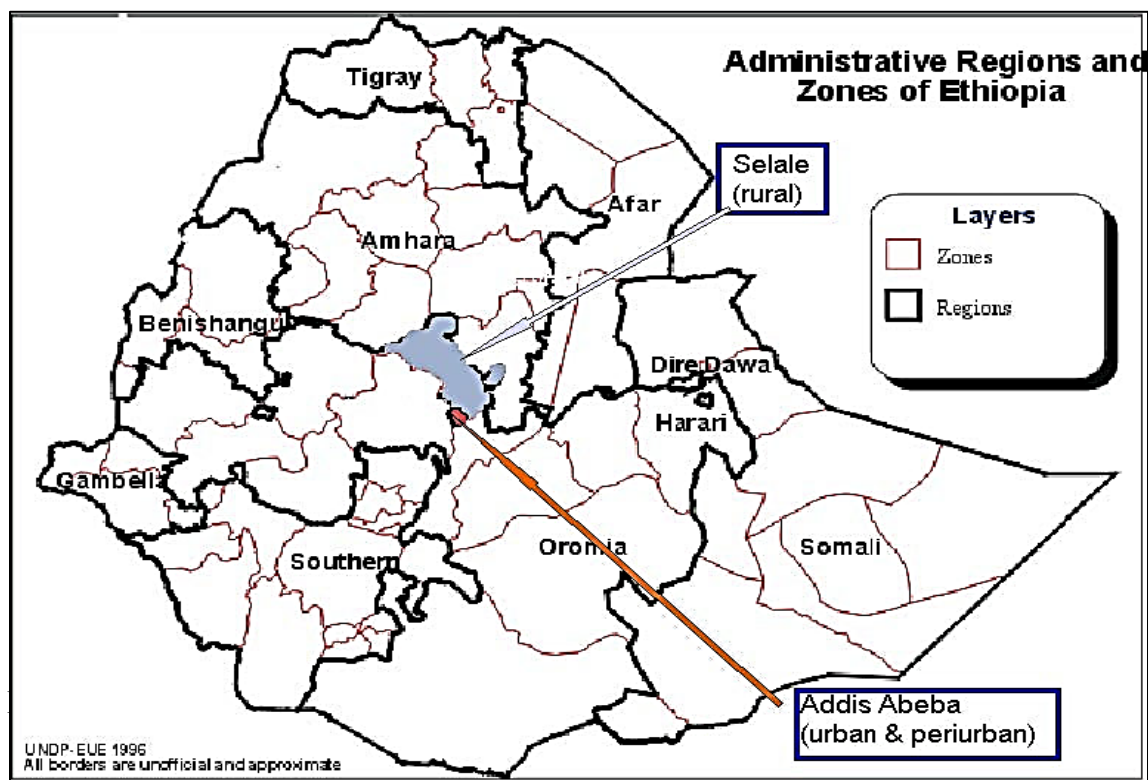


Figure 4.1: Map showing the study area

Data Collection and Sampling Procedure

A structured questionnaire was administered to collect data from a total sample of 384 smallholders (192 cooperative members and 192 non-members). Five cooperatives (Chanco, Lelistu, Nano Seyu, Debre Tsige and Torbanashe) were randomly selected from the 24 primary cooperatives operating in the area. All these cooperatives form a union, which is in charge of bulking and commercializing raw milk (mainly in the capital city, Addis Ababa). Proportional random sampling was applied to select members from the selected five primary cooperatives. Non-members were selected from the same kebeles (lower administrative unit in Ethiopia) where the 5 selected cooperatives are located. These farmers were randomly chosen from a list of kebele's dwellers (every kebele holds a census of its inhabitants).

Matching

Data were analyzed using STATA version 10 software. A binary logistic regression model was applied to assess the relationship between membership (1=member; 0=non-member) and households characteristics. The probability of being a cooperative member can be modeled as a function of selected independent variables. To estimate the impact of cooperative membership on selected outcome variables, we applied a Propensity Scores Matching (PSM) technique to control for biases that may exist between the two groups (members and non-members). This technique has been successfully implemented by Francesconi (2009), Getnet and Anullo (2012) and Bernard et al. (2008a) in evaluating the impact of cooperative membership among Ethiopian farmers.

The main challenge for the estimation of “impacts” of membership is to construct the counterfactual $E(Y_0 | D=1)$, namely the outcome cooperative members would have experienced, on average, had they not participated as members in a cooperative. Since the counterfactual can never be directly observed, statistical approaches are required to identify appropriate comparison or control groups. There are a number of biases that we face in doing so. The fact that our samples were drawn from the same areas might constitute a source of potential bias, arising from possible spillover effects. Non-members may obtain indirect benefits from cooperatives’ activities. In addition, members and non-members differ in several observable characteristics (such as age, education, family size, land size, etc), which may influence the probability of cooperative membership. In addition, cooperative members and non-members may differ along unobservable variables, which might have a direct influence on outcomes (the selected impact indicators). Therefore, a simple comparison of these two groups may result in serious biases and misleading conclusions. Propensity Score Matching is one of the available econometric techniques to deal with these biases (Heinrich et al., 2010).

In the current study, we focus on the following specific indicators as outcome variables: (1) Proportion of dairy income to total household income⁹ (2) Total dairy income (3) Technological

⁹ Total household income in this study refers to aggregate household income from livestock sales, crop sales, dairy sales and off-farm/sideline jobs.

innovation (proportion of crossbreed cows to the total number of cows in the herd) (4) Milk productivity: ratio between milk daily production (liters) and the number of milking cows available per farm (5) Milk production (6) Price per liter of milk (7) Commercialization: the proportion of milk marketed in its raw state to the total milk production on a daily basis, and (8) Share of milk processed: the proportion of milk allocated to the elaboration of dairy products (butter; cheese) to total milk production. Sharma et al. (2009) also used the percentage of crossbred cows in dairy herd as an indicator of technology adoption. Undoubtedly, there are various indicators that may be used for technological innovation. Nonetheless, in the current study we focus on the adoption of breed type, due to its effects on productivity

For estimating each household's "propensity score", cooperative membership is modeled as a function of a number of household characteristics. The choice of the independent variables in the model is crucial in the analysis. Only variables that are unaffected by participation should be included in the model. Hence, Caliendo and Kopeinig (2005) suggest that these variables should either be fixed over time or measured before participation. Following their suggestion, the following independent variables were selected for the model: age of household head, (age of household head)², level of education, family size, proportion of female of working age (above 12 years old) in the household, dairying experience, land size and distance to milk collection centre.

PSM is expected to provide a weighting scheme that yields unbiased estimates of the treatment impact. Given the aforementioned indicators, we aim to calculate the average treatment effect on the treated (ATT) as given in *Equation 1*. That is, the impact of dairy cooperative membership on output indicators. This effect (ATT) is denoted by Caliendo and Kopeinig (2005) as;

$$\hat{\tau} ATT = E(\hat{\tau} | D = 1) = E[Y(1) | D = 1] - E[Y(0) | D = 1] \quad (1)$$

Where

Y_0 = outcome in control group

Y_1 = outcome in treatment group

Several matching algorithms are available for PSM. In this study we employ two algorithms: (1) nearest neighbor (NN) matching ‘with replacement’ and (2) kernel matching. In the NN matching the individual from the control or comparison group is chosen as a matching partner for a treated individual that is closest in terms of propensity score. Unlike matching ‘without replacement’, matching ‘with replacement’ allows an untreated individual to be used more than once as a case. This is the main reason why we have applied the latter. However, matching with replacement involves a trade-off between bias and variance. Kernel matching is a non-parametric matching estimator that uses weighted averages of all individuals in the control group to construct the counterfactual outcome. In this method, each treated household is matched with the entire sample of controls. This approach uses more information, thus lowering variance. However, its drawback is that it might include observations that are bad matches. Using both methods (nearest neighbor matching with replacement and kernel matching) provides a natural robustness check to guard against the disadvantages of the two matching procedures.

To ensure maximum comparability of the treatment and control groups, the sample is restricted to the common support region, defined as the values of propensity scores where both treatment and control observations can be found. By imposing a common support condition, we can minimize the main limitation of the kernel matching approach and improve the quality of the matches. Observations outside the common support are not considered in our model, by imposing a common support condition and by eliminating the 5%¹⁰ of the treatment observations for which the propensity density of the control observations is the lowest. This implies that after units are matched, the unmatched comparison units are discarded and are not directly used in estimating the treatment impact.

4.4 Empirical Results

This section presents our descriptive and econometric results. The descriptive results consist of a series of t-tests, for conducting simple comparisons between members and non-members. Later, we present the results related to the probability of cooperative membership (logit model), and

¹⁰ Though 5% is generally used, there is no consensus in the literature about which common support cut-off point is the most appropriate.

then the results from the two matching algorithms for assessing the impact of membership on the eight selected outcome variables.

Descriptive statistics

We ran a series of t-tests on a number of variables for conducting simple comparisons on household characteristics between members and non-members. Table 4.1 presents the outcome of the t-test analyses. We also show in the same table the t-test statistics on the impact indicators selected for the study.

Table 4.1 Descriptive statistics for members and non-members

Variable	N	Members	N	Non-members	t-test (p-value)
Control variables					
Age	192	48.67 (0.989)	192	45.55 (1.067)	2.144 (0.033)**
Age ²	192	2555.93 (100.409)	192	2292.56 (106.340)	1.801 (0.073)*
Family size	192	6.60 (0.191)	192	5.79 (0.168)	3.198 (0.002)**
Dairying experience (years)	192	21.44 (0.835)	192	22.09 (1.037)	-0.489 (0.625) ^{NS}
Distance to milk collection centre or market (km)	192	1.06 (0.019)	178	1.24 (0.035)	-4.377 (0.000)***
Land size (ha)	171	2.75 (1.381)	185	2.58 (1.551)	1.076 (0.283) ^{NS}
Impact indicators					
Proportion dairy income	192	0.69 (0.023)	192	0.57 (0.028)	3.334 (0.000)***
Total dairy income (Birr)	192	25067.06 (1915.90)	192	7873.03 (767.53)	8.331 (0.000)***

Technological innovation	192	0.755 (0.025)	192	0.428 (0.029)	8.466 (0.000)***
Milk production (liters/day)	190	20.12 (1.350)	183	7.53 (6.602)	8.770 (0.000)***
Milk productivity (liters/cow/day)	190	8.33 (0.358)	183	4.34 (0.221)	9.466 (0.000)***
Share of processed milk (liters)	190	0.06 (0.014)	181	0.47 (0.032)	-11.601 (0.000)***
Commercialization (share of sold liquid milk-liters)	190	0.87 (0.015)	181	0.46 (0.034)	11.186 (0.000)***
Average price/liter (Birr)	180	5.10 (0.021)	89	5.10 (0.029)	0.042 (0.967) ^{NS}
Price per kilo of butter (Birr)	50	67.38 (5.858)	109	80.32 (2.628)	-2.016 (0.048)**

*** P<0.01, ** P<0.05, * P<0.10

^{NS} = not significant

Notes: Standard error in parentheses

Figures in bold shows the variables that were not included in the analysis due to small sample size

The households of cooperative members have on average more family members, and are headed by older persons who also hold a higher level of education, as compared to non-members. In addition, the mean distance to milk collection centre or market was significantly lower among cooperative members. With the exception of the average price per liter of milk, there are significant differences between both groups for all the selected impact indicators. It is important to note however that robust conclusions can only be derived with the combination of t-test analyses with the outcomes of matching techniques, due to the potential bias problems outlined above.

Binary logistic model results

Out of the 8 variables we included in the logistic model for assessing the likelihood of membership, 5 were significant (see Table 4.2). These were age of household head, family size, land size, level of education and distance to the cooperative milk collection centre.

Table 4.2 Probit model estimates for the probability of cooperative membership

Membership	Coef.	Std.Error	z	P> z
Age	.078	.037	2.13	0.033**
Proportion of female	.669	.409	1.64	0.102
Family size	.103	.033	3.17	0.002***
Education level	.431	.075	5.72	0.000***
Total land size	-.001	.000	-2.00	0.046*
Farming experience	-.008	.008	-0.97	0.333
Distance to collection centre	-.822	.210	-3.92	0.000***
Age ²	-.000	.000	-1.35	0.178
Constant	-3.221	.907	-3.55	0.000***

Note: *** P<0.01, ** P<0.05, * P<0.10

Number of observations = 369

LR chi2 (8) = 91.64; Prob > chi2 = 0.0000

Pseudo R2 = 0.1794; Log likelihood = -209.65

Our results (see Table 4.2) show that the distance to the milk collection centre negatively and significantly influence the probability of cooperative membership. Age and level of education of household head as well as the household size were also found to have a significant and positive relationship with the probability of cooperative membership. There is a negative relationship between land size and membership, implying that the probability of cooperative membership declines with an increase in land size. Dairying experience, proportion of females and age² were not significant in explaining membership.

Average impact of cooperative membership

The significant differences in the observable characteristics between members and individual farmers (Table 4.2) show that matching techniques are required to ensure robustness of our estimates. In Table 4.3 we report the *average treatment on the treated* (ATT) – the mean impact that dairy cooperative membership has on its members along a number of variables.

Table 4.3 Impact of cooperative membership on dairy farmers

Outcome	Cooperative members	Non-members	t-test	ATT (NN)	ATT (Kernel)
Proportion dairy income ^a	0.69 (0.023)	0.57 (0.028)	3.334 (0.000)***	0.068 (0.058)	0.066 (0.051)
Total dairy income (Birr) ^a	25067.06 (1915.90)	7873.03 (767.53)	8.331 (0.000)***	15483.10 (2266.57)***	14799.52 (2346.53)***
Technological innovation ^a	0.755 (0.025)	0.428 (0.029)	8.466 (0.000)***	0.223 (0.065)**	0.270 (0.057)***
Milk production (liters/day) ^a	20.12 (1.350)	7.53 (6.602)	8.770 (0.000)***	10.591 (1.573)***	10.051 (1.570)***
Milk productivity (liters/cow/day) ^a	8.33 (0.358)	4.34 (0.221)	9.466 (0.000)***	3.057 (0.550)***	3.237 (0.528)***
Share of processed milk (liters) ^a	0.06 (0.014)	0.47 (0.032)	-11.601 (0.000)***	-0.355 (0.065)***	-0.355 (0.055)***
Commercialization (liters) ^a	0.87 (0.015)	0.46 (0.034)	11.186 (0.000)***	0.360 (0.069)***	0.364 (0.059)***
Price per liter of milk (Birr) ^b	5.10 (0.021)	5.10 (0.029)	0.042 (0.967)	0.102 (0.061)	0.087 (0.052)

Notes: ^a Number of observations = 356 ; ^b Number of observations = 268

Common Support= 347

Common support = 259

*** P<0.01, ** P<0.05, * P<0.10

Standard errors in parentheses. ATT is equal to the outcome of cooperative farmers minus the outcome of individual farmers after Propensity Score Matching.

Currency for income is in Ethiopian Birr (1 USD = 16.9886 ETB as of August 2011).

Standard errors for NN and Kernel matching computed using 50 bootstrap replications.

Significance levels based on Bias-Corrected confidence intervals.

^b The price per liter was run separately due to a relatively smaller sample size.

We found that, on average, cooperative members obtain between 14,799 Birr and 15,483 Birr higher total annual dairy income than the non-members ($p < 0.01$). Furthermore, on average the index of technological innovation is between 0.22 and 0.27 higher among cooperative members. This variable is significant at the 1% significant level for the kernel matching and at the 5% significance level for the NN matching algorithm. The milk production, milk productivity, and level of commercialization are also higher among cooperative members. These results are significant at the 1% significance level and robust across the two matching algorithms (nearest neighbour and kernel matching). We also found, using both matching algorithms, that the share of processed milk is 0.35 higher for non-members. This means that non-members allocate a considerably higher proportion of the total milk production to the production of dairy products, such as butter and cheese. Lastly, based on the two matching algorithms, we found no evidence of the impact of cooperative membership on price per liter of milk and also for the proportion of dairy income to total income.

4.5 Discussion and policy implications

The “middle class effect” proposition states that the probability of cooperative membership is higher among landholders with intermediate levels of assets (Bernard and Spielman, 2009). This effect could be explained by the conditions under which collective action can be effective for landholders. Though the evidence is not yet conclusive, several studies have shown that collective action among farmers is more likely to be effective at intermediate levels of resources, assets or transaction costs. Our findings shed mix evidence on this proposition. Contrary to the results of Bernard and Spielman (2009), we have found a negative relationship between land size and the likelihood of cooperative membership. This means that the poorest landholders (smallest) are actually benefiting from cooperative membership, which implies that coops can indeed play an important role in poverty alleviation among dairy producers. In addition, similar to what has been reported by Fischer and Qaim (2012) and Abebaw and Haile (2013), our results reveal that older and more educated farmers are more likely to join marketing cooperatives. Furthermore, we found a negative relationship between distance to the collection centers and the probability of cooperative membership. Similar results have been reported for dairy farmers by

Francesconi (2009) in Ethiopia and Sharma et al. (2009) in India. This is in line with the findings reported by Fisher and Qaim (2012) and Abebaw and Haile (2013), who show a non-linear relationship between the distance to the road and cooperative membership among farmers in Tanzania and Ethiopia respectively. In both cases, distance to the road is positively related to cooperative membership up to a threshold level, after which a negative relationship between both variables is found. Such pattern might also arise in collective institutions for the management of common pool natural resources. Bardham (1993), for example, argues that community-based irrigation systems are more effective at intermediate levels of water scarcity. Much further research is needed to test empirically under which conditions the middle class effect proposition might hold.

Dairy production is labor intensive. A higher level of market integration requires more labor to carry out dairy production activities, such as milking, cleaning the barns and transporting the milk to the collection centers. The availability of family labor can be a critical factor determining the transformation from extensive to intensive dairy production systems. It is therefore reasonable to expect a positive relationship between household size (number of household members) and the likelihood of joining a dairy cooperative, as we have found. We have also found that cooperative membership has a strong and significant positive impact on technological innovation, production and productivity. These findings confirm the results of Francesconi and Ruben (2012) and can be attributed to a shift towards dairy intensification by cooperative members, achieved mainly by means of acquiring improved breeds of cows. Dairy intensification is expected to have a positive effect on economic efficiency (Alvarez et al., 2008). As a consequence, herds of cooperative members are dominated by high-yield crossbred cows, as opposed to the zebu cattle typically found in the herds of non-member farmers. Several studies have found that one of the key functions of cooperatives is to facilitate innovation and access to technology. Odoemenem and Obinne (2010), for instance, found out that cooperative membership was one of the most important factors determining the adoption of improved cereal crop production technologies among cereal growers in Nigeria. Getnet and Anullo (2012) also show that agricultural cooperatives induce the adoption of improved seeds and fertilizers among farmers in Ethiopia. Fischer and Qaim (2012) provide evidence about the positive impact of

cooperative membership on technological innovation, which includes the use of tissue culture and chemical inputs among the banana producers in Kenya. Devaux et al. (2007) also report that collective action plays an important role in commercial and technological innovation among potato producers in the Andes in South America. In our case, it is clear that the cooperatives provide an environment suitable for dairy intensification by means of facilitating the dissemination and adoption of productivity enhancing technologies, and in particular new cow varieties and the use of animal feed.

Our results also show that dairy cooperatives positively influence the level of commercialization of its members. Dairy cooperatives provide marketing services to their members through bulking, transportation and securing buyers. Furthermore, most cooperatives are now engaged in processing of milk into less perishable products such as cheese, yoghurt and butter. It is therefore not surprising that a higher proportion of milk is allocated to the market among cooperative members, as compared to non-members dairy farmers.

Our findings nonetheless reveal that the impact of cooperative membership on the price of milk is not significant. It is worth noting that the price reported by the cooperative members excludes the dividends that they receive at the end of the year, depending on their patronage. Though dairy cooperatives in our study area might induce a “competitive yardstick” effect (inducing a general higher price at the local level, among both members and non-members), the lack of significant higher prices among members probably indicates a trade-off between different cooperative functions (and more particularly in this case between technological transfer and price). It also poses a challenge, since the potential of higher prices, compared to traders, constitute one of the main motivations for farmers to join marketing cooperatives. The inability to offer better prices might jeopardize the long-term viability of the cooperatives in the study area, since they compete harshly with local traders, and prices play an important role in such competition. This is aggravated by the fact that members are not obliged to deliver to the cooperatives. They can therefore benefit from other cooperative services (technological transfer, credit, access to inputs, etc.) but deliver their production to competitors, which would in the long-run undermine cooperative performance.

Gaps between different cooperative functions are well reported in the literature, and they seem to be more likely to occur in cooperatives at early stages of development (not yet well consolidated). For instance, Bernard et al. (2008b) point out that market-oriented farmers' organizations in Senegal and Burkina Faso are relatively good in providing information and advice to their members but are relatively weak in facilitating access to financial services, materials and infrastructure investment. Furthermore, Bernard et al. (2008a) and Francesconi and Heerink (2010) show that, overall, multi-purpose cooperatives in Ethiopia can offer better prices, but have a limited capacity to enhance the level of market integration (commercialization), particularly among the smallest farmers. On the contrary, Fisher and Qaim (2012) report that marketing groups increase the level of commercialization and income among banana growers in Tanzania, but they found that the effects on prices are very modest. Mujawamariya et al. (2013) found that coffee cooperatives in Rwanda ensure higher and more stable prices (in comparison with private coffee traders). However, they were not able to pay on the spot or to offer advance credit, which explains why farmers still deliver an important share of their production to traders (who are able to provide these important services).

Our findings identify two main areas of action for interventions aiming to improve the performance cooperatives in the study area: (i) Strengthening marketing services in order to induce higher prices among members. Two options available to the union of cooperatives (in charge of commercialization of the milk production from all cooperatives in urban areas) are the establishment of new marketing links with special buyers of raw milk (schools, restaurants, etc.) and to engage in product differentiation (higher quality) that can reap a higher price among processors. Given the lack of enforced quality standards in the dairy sector in Ethiopia, product differentiation could become eventually an important source of additional income. This would require however to put into place strict horizontal coordination mechanisms among members (since quality improvement needs concerted actions). (ii) Improving knowledge transfer and infrastructure for the management of cross-breed cows, which is expected to increase the nutritious quality of milk (protein and fat content). The trade-off between productivity and quality is not intrinsic to the use of cross-breed cows, it is rather the result of inappropriate cattle

management practices. Cooperatives can be instrumental in inducing the necessary changes in management practices among members through knowledge transfer and investment.

CHAPTER 5. Knowledge Systems and Value Chain Integration: Case of Linseed Production in Ethiopia

Abstract

This study uses data from a sample of 150 oilseeds farming households from Arsi Robe, Ethiopia, to assess the impact of different knowledge bases (education, training and experience) and their interactions on linseed productivity. Other determinants of linseed productivity that we analyzed include age of household head, land size, marketing channels and geo-physical factors such as land slope. We find that training and the interaction of training and experience positively influence productivity. However, our estimates further reveal farmer education to have an inverse but insignificant effect on productivity. Furthermore, we find that factors such as the slope of land and the choice of marketing channel also plays an important role in influencing productivity. Our findings suggest that it is important to invest in training of more experienced farmers who can in turn transfer their skills to other farmers thereby improving overall productivity. Most significant productivity effects are derived, however, from direct interactions of farmers with the market.

Keywords: Knowledge systems; training; education; market knowledge; linseed; Ethiopia.

5.1. Introduction

The Ethiopian oilseed sector is composed of more than three million smallholders (Wijnands et al., 2007, Allaro 2011). There is growing demand for oilseeds both on the domestic (where it is used to produce edible oil and oilcake) and international markets. According to Fanta (2005), the major destinations of Ethiopian oilseeds export by region are the Middle East, Asia (South and South East) and the European Union (EU). Ethiopia is the 5th world producer of linseed (Wijnands et al. 2007). Oilseeds, which are the second largest export earner for Ethiopia after coffee, accounts for 20% of export revenues (Wijnands et al., 2007; Sertse et al., 2011). With this great export potential, many governmental organizations and non-governmental organizations (NGOs) have engaged in interventions to support farmers and other involved stakeholders to improve oilseeds production. Apart from being an export crop, oilseed also plays an important role in the domestic economy by serving as main raw material for local oil processing industries and in employment creation (Fanta, 2005). Despite the country being a major exporter of oilseeds, shortage of oil to satisfy the local market demand remains a critical problem yet to be solved. Wijnands et al. (2007) highlight that Ethiopia is still hugely dependent on refined oil imports such as palm oil and soybean from Italy and Turkey for its domestic use. The Ethiopian government is aiming to achieve self-sufficiency in edible oils by 2015 (Sertse et al., 2011).

The main oilseeds grown in Ethiopia are sesame, noug seed and linseed, which together account for 86% of national oilseeds production (Sertse et al., 2011). According to Agonafir and Abraham (2012), linseed is the third exportable oilseed after sesame and Noug, and it is used as industrial oil (i.e. in manufacturing of oil paints, varnishes and floor covering). Linseed is gaining increasing importance for the food industry in highly developed consumer markets due to the specific non-saturated fatty acids (Wijnands et al., 2007). There has been a rise in demand for linseed in the world market and as one of the major producers Ethiopia is well positioned to benefit from this opportunity by increasing exports to EU countries (Agonafir and Abraham, 2012). In the study area (Arsi Robe), the 2004/05 production shows that linseed is the most grown oilseed crop, contributing to 88.8% of total oilseeds production while Noug seed accounts for the remaining percentage (Fanta, 2005). The main reason for farmers' preference for linseed is because it fetches higher prices and productivity, as compared to Noug.

With regard to the marketing channels, producers can market their produce through either their primary cooperatives or through private traders (also known as local assemblers). Farmers can also sell directly to retailers and local oil processors who will in turn sell the processed oil to local customers. Private traders, sell the produce to local oil processors in Addis Ababa or Nazareth and also to exporters. Primary cooperatives collect linseed from their members and channel the produce to Didaa union cooperative. The union nowadays sells the linseed to numerous buyers, including oil processors, exporters and traders at the national level (Muradian et al., 2012). The union managed to expand its customer base by participating in the multi-stakeholder platform for the oilseeds facilitated by the Dutch development agency SNV through an intervention. This intervention had to do with the strengthening of the oilseeds sector through training of oilseeds farmers within the Didaa Cooperative Union on good agricultural practices (GAP) and setting up of the oilseeds multiplication system.

Dating back to 2005, the oilseeds sector has been identified, among others such as dairy, honey and pineapple, by SNV as a potential target for value chain development. SNV identified as major challenges of the sector, among others, its low productivity and lack of technical know-how (Muradian et al. 2012). The main aim of SNV's intervention was to enhance producers' market linkages through improved productivity and commercialization. With regard to commercialization, at times the cooperatives faced shortages of supply from their members. Didaa, a multi-purpose¹¹ cooperative union in Arsi Robe, was selected to facilitate its intervention through training on good agricultural practices (GAP) and for seed multiplication program.

The training methodology followed by SNV in collaboration with Didaa Union targeted local extension agents from the government who in turn replicated the training and provided follow-up technical support to farmers. The training was conducted in 2007 and covered agricultural production techniques, land preparation, quality management, post-harvest storage and marketing. A total of about 2,500 farmers from several primary cooperatives were trained. This

¹¹ Besides oilseeds, the cooperative also collect and market other crops such as spices, teff, wheat, etc. and engages in provision of inputs such as fertilizers and service goods, hence linseed is not its core business.

was followed by the participation of 29 smallholder farmers and 10 extension agents in the training on seed multiplication and quality control in 2009.

Most trainings were production-related and less oriented towards commercialization of the oilseeds. As highlighted by Belayneh and Alemayehu (1988), management practices are highly critical in linseed (*Linum usitatissimum* L) production because linseed yield is much affected by weed control and sowing date. For instance, the first early weeding (3-4 weeks after planting) is very critical. Also, a delay in sowing date from mid-June to mid-July could cause a yield loss as high as 30%. Interaction between market knowledge and production knowledge is thus considered highly valuable.

Just like in any other sector, there are different ways in which farmers might acquire knowledge. For instance, in the linseed sector producers may learn differently how to cultivate linseed due to historical knowledge (experience), acquired knowledge (education) and technical training (value chain input). This implies that the knowledge bases (identified as experience, education or training) may induce variations in productivity among households, hence it is expected to generate different contributions to productivity amongst farmers. Another important knowledge base is called “tacit knowledge”. Farmers are integrated into the value chain through several alternative channels. In this study, we argue that it is through these market linkages that the farmers can also acquire tacit knowledge. This phenomenon has been described by Boateng (2006) as being experiential in nature and acquired after an exemplary practice has been put to use over a period of time.

In addition to the knowledge bases mentioned above, there are some physical or environmental factors that may also affect linseed productivity. For instance, Feder et al. (2004) attributed the lack of significant impact of the farmer field school programs (FFS) training on yields to some systematic factors which may influence productivity, such as soil fertility, plant diseases and climate trends. The research questions guiding this study therefore are:

1. Did technical training improve linseed productivity?

2. In what way do market linkages provide tacit knowledge?
3. Apart from the knowledge bases and their interactions, what other factors affect linseed productivity?

This study was designed to analyze how the knowledge bases of farmers affect linseed productivity. The paper proceeds as follows. Section 5.2 presents the conceptual framework on the effect of different knowledge bases and their interaction on farmer productivity. In this section we also provide a theoretical background on the factors affecting the farmers' choice of market outlet. The methodology, including the sampling strategy and methods of data collection and analysis, is presented in Section 5.3. We present our empirical findings in Section 5.4. We finally conclude with some policy implications in Section 5.5.

5.2 Conceptual framework

As mentioned earlier, farmers have different options available for acquiring knowledge about how to produce and sell a certain crop. Such knowledge sources (education, farming experience and training) have received much attention in the literature on how they can influence productivity among farmers. However, the evidence on how these knowledge bases influence agricultural productivity is mixed and there is little to no evidence on how their interactions could affect farm productivity. For instance, Agyei-Holmes et al. (2011) argue that the agriculture industry has managed with little or no education and/or training. In this regard, some other studies have found even a negative relationship between schooling and farm productivity. For example, Hasnah et al. (2004) show a negative impact of education on technical efficiency amongst oil palm producers in West Sumatra. Empirical evidence by Evenson and Mwabu (2001) shows that schooling has an insignificant effect on crop yields for 13 different crops in Kenya. Similarly, Battese and Coelli (1995) did not find also any significant impact of farmers' education on farming efficiency in India. Asadullah and Rahman (2005) also argue that - despite the common beliefs regarding the benefits of schooling in farm activities - there is weak empirical evidence about the impact of educational investment in agrarian societies. Other authors found, however, that the initial years of schooling can positively influence productivity. For instance, using data from 978 households in China, Nguyen and Cheng (1997) investigated

whether education has an effect on farm efficiency. They found that it is only the first three years of household head education that has an effect on farm productivity, while education beyond these first three years is of little effect on productivity. Several studies (Pudasaini, 1983; Schultz, 1975) have been carried out to compare the effect of education on productivity in modern agriculture and traditional agriculture. The results from these studies show that education contributes more to productivity in modern agriculture because of its interaction with other factors of production such as improved inputs and machinery, etc.

When we look at farming experience, there is also mixed evidence in the literature. For instance, Epeju (2010) found that years of farming experience in growing sweet potatoes, among other factors, positively and significantly increases sweet potato productivity. Quite to the contrary, Nguyen and Cheng (1997) found no evidence on the impact of farm experience on productivity in China. Other authors such as Okoye et al. (2008) also found a not significant influence of farming experience on productivity among male farmers. For female farmers, experience, education and number of extension visits were, among other factors, significantly and positively related to productivity. Djomo and Sikod (2012), on the other hand, found that an additional year of experience reduces production among farmers in Cameroon. However, their results further show that an additional year of experience squared (Experience^2) increases production, revealing that only in the long term producers become more productive.

Trainings are expected to assist farmers to improve their farming technical skills and consequently their productivity. Feder et al. (1987) studied the effect of Training and Visit System (T&V) on wheat farmers in India. Their results show that the T&V system significantly increases wheat productivity. On the other hand, Ousman (2007) argues that the contribution of training to agricultural development is undeniable, but some doubts arise over its effectiveness and efficiency. Ousman's argument is supported by the findings of Feder et al. (2004), who show little significant impact of FFSs on crop yield in Indonesia.

Another important source of knowledge which has been discussed in the literature is the tacit knowledge (Nonaka, 1991; Boateng, 2006). Farmers have access to both tacit (informal) and

explicit (formal) information. The over-reliance on scientific knowledge and the neglect of farmers' tacit knowledge in agricultural extension practice has long been identified as an impediment to increased agricultural productivity (Boateng, 2006). In our case, tacit knowledge entails how market linkages could provide information to the farmers through the buyer-seller information exchange. We focus on this type of tacit knowledge because weak market linkages have been identified as one of the challenges within the oilseeds sector. Since there are different market channels for linseed available in the area, we argue that the most commonly used channel could provide tacit knowledge to the farmers. This may include price information, quality requirements and optimal timing of sales that are recognized by the market. As illustrated in Figure 5.1 the interaction of farmers with their market outlets, private traders and cooperatives provide them with the kind of knowledge (such as price information, quality requirements, etc.) they cannot usually obtain through formal education or training.

Following the discussion above, we argue that the knowledge bases could complement each other. A single source may not be adequate for achieving higher productivity. For instance, a farmer may have agricultural knowledge based on experience with old but outdated information on traditional production methods. This kind of experience may not be fully useful for the farmers; hence it might need to be complemented with some other kind of training to improve farmers' technical know-how. The interaction of human capital factors we consider in this study can be analyzed from the viewpoint of Agricultural Knowledge and Information Systems for Rural Development (AKIS). As defined by FAO and World Bank (2000), this knowledge system links farmers and institutions and facilitate the integration of farmers, agricultural educators, researchers and extensionists to harness knowledge and information from various sources for better farming and improved livelihoods that could generate higher income. With ideas from the "knowledge triangle" by FAO and World Bank, we developed a conceptual framework presented in Figure 5.1. The figure illustrates how the knowledge bases (education, experience and training) and their interactions affect productivity among linseed producers in the study area.

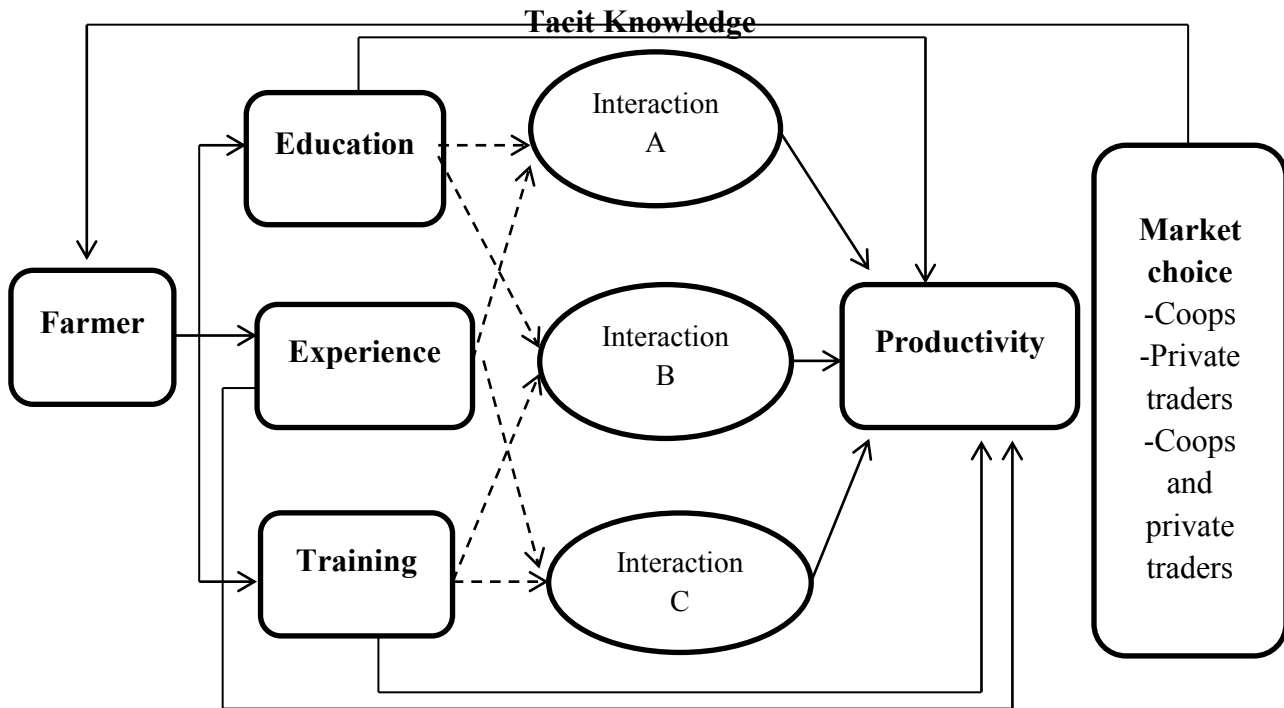


Figure 5.1: Conceptual framework on knowledge bases

The conceptual framework consists of four different knowledge bases, namely education, experience, training and tacit knowledge (derived from market exchange). Our framework suggests that an interaction of these knowledge sources could be more effective in improving productivity (more than it could be with one knowledge base). Hence, there is an interaction between components of human capital such as technical training, the level of education and/or the years of farming experience that can influence farmers' productivity in one way or the other.

Very little, if anything, has been said in the literature on the influence of various knowledge bases on productivity and on how market linkages could provide tacit knowledge to linseed farmers in Ethiopia. Our study aims to fill this gap. The major contribution of this paper to the debate on knowledge systems on agricultural development is that it includes the interactions between different knowledge bases as a key element in the process to agricultural intensification.

5.3 Methodology

This section describes the study area and presents the sampling strategy that was employed for selecting the respondents. The type of data gathered and the methods of data analysis are also presented in this section.

5.4.1 Description of the study area

The study was carried out in the Arsi Robe district in the Oromia Region of Ethiopia. This area was selected because of a number of reasons. Robe is one of the major oilseeds producers in Arsi Zone. According to Fanta (2005), Noug seed and linseed are the two main oilseed types grown in Robe Woreda. The area was identified and selected by SNV in its value chain intervention programs. The altitude of the Robe Woreda ranges from 1200 to 4000 meters above sea level.

5.4.2 Sampling Strategy for Didaa Cooperative Union

The Didaa cooperative union is made up of 27 primary cooperatives, with a total membership of about 21.000 farmers. All these primary cooperatives are situated in 6 Woredas (districts). In total, the union has 1.336 females and 19.773 males' members. 17 primary cooperatives were trained on good agricultural practices (GAP). In total, 3.000 farmers participated in the training. On the other hand, only 2 primary cooperatives (Cheffef and Bulala) participated in the seed multiplication program provided by SNV. From each of the 2 cooperatives, 15 members participated as seed multipliers¹² (30 in total). However, this group of farmers was excluded from the sample since the main focus of our study was on the performance of "regular" farmers who only received the GAP training. Also the inclusion of the farmers who received training on seed multiplication may also yield biased results.

Cheffef and Bulala are the only cooperatives that were considered in the current study. A total of 100 (50 from each) members were selected from these two primary cooperatives as the treatment group (farmers who have participated in the GAP training). In addition, from each cooperative, 25 farmers (50 in total) were randomly selected from those producers who did not participate in

¹² Seed multipliers are the farmers who were selected to receive additional training on production of improved linseed and quality control.

the training (control group). Overall, 150 farmers were interviewed. Those who were not turning up for the interviews were replaced by nearest available farmer on the list provided by the union.

5.4.3 Data

The complete list of oilseed farmers in the area was obtained from Didaa union office. We used a structured questionnaire to gather some basic economic and demographic information from the households. The data collected include linseed farming experience, the terrain of the land, age, land size, level of education, training, market channels, contracts, etc. We developed a number of interaction terms of training with linseed farming experience and dummies for the level of education. We also obtained secondary information from the union as well as the Robe Woreda Agricultural office.

To assess the combined effect of the knowledge bases and other factors mentioned above on linseed productivity, we employed a multiple regression analysis. We tested for multicollinearity among the independent variables using the variance inflating factor (VIF) and the tolerance level. A VIF that is closer to or more than 10 suggest a high degree of multicollinearity. In addition, a tolerance level less than 0.1 suggest a high degree of multicollinearity. We employed a Chow test, an econometric model that is regarded as a standard procedure for inferring whether regressions may be *pooled* (Chow, 1960). Basically, by using this model we aim to find out if the regression model explaining linseed productivity of the trained farmers is different from the regression model explaining non-trained farmers' productivity. Our F-test (see the analysis in Appendix A) was smaller than the critical values both at the 1% and 5% significance level, leading to a conclusion that no structural change is observed. This means that the regression line is the same for both the trained and non-trained groups, hence we carried out a multiple regression analysis only for the pooled sample.

5.4 Empirical results

This section presents the findings of the study. We first sub-section shows the descriptive results and then we proceed with the empirical findings.

5.5.1 Descriptive statistics

Table 5.1 presents the results on the characterization of linseed producers. The mean age of farmers in the study area is 47 years. On average, the farmer respondents have 16 years of linseed farming experience. The average land size is 2.3 hectares. On average, the respondents have been cooperative members for 22 years. In the study area, average linseed productivity for the year 2010 was 339kg/ha. When we look at the marketing channels the results shows that in 2010, on average the proportion of the harvested linseed sold to cooperatives was 0.16 while a proportion of 0.36 was marketed through private traders. On average, private traders offers a higher price per kilo of linseed as compared to cooperatives.

Table 5.1 Descriptive data characterizing respondents

Variable	Mean	Std. Deviation
Age (years)	46.81	10.76
Experience in linseed production (years)	15.92	9.68
Total land size (ha)	2.29	1.13
Duration of cooperative membership	21.53	11.15
Linseed production (kgs): 2007	234.60	215.17
2008	143.84	164.23
2009	133.16	165.06
2010	119.34	158.38
Linseed productivity 2010 (kg/ha)	338.58	387.34
Change in linseed productivity (kg/ha)	-271.54	592.42
Proportion of linseed sold to own cooperative in 2010	0.16	0.36
Price offered per kilo by own cooperative (Birr)	1.11	2.56
Proportion of linseed sold to private traders in 2010	0.36	0.47
Price offered per kilo by private traders (Birr)	3.00	4.14

Table 5.2 presents the descriptive data on the categorical variables. We developed a number of dummy variables on education, slope of land, marketing channels and the type of contract. The results show that the majority (60.7%) of the farmers have a high (= 1) level of education whereas 39.3% have attained a low (= 0) level of education. The majority of the farmers (51%) indicated that the terrain of their land is of mixed nature (have both steep and gentle features) whereas 21% of the farmers indicated their land as gentle. Most farmers (63%) market their linseed produce through private traders whereas 57% of the respondents market through their own cooperatives. 19% of the farmers indicated that they use both channels (cooperatives and private traders).

Table 5.2 Descriptive statistics on categorical variables

Variable	Frequency	%
Education: 1 High education	91	60.7
0 Low education	59	39.3
Slope of land: Flat	33	22.0
Gently slope	31	20.7
Steep	9	6.0
Mixed	77	51.3
Did you receive training: 1 Yes	100	66.7
0 No	50	33.3
Do you get dividend: 1 Yes	55	36.7
2 No	95	63.3
Kind of contract with coop: 1 Written	54	36.0
2 Verbal	50	33.3
3 No contract exists	46	30.7
Marketing channels: Cooperatives	84	57.1
Private traders	92	62.6
Both cooperative and private traders	28	19.0

5.5.2 Regression analysis

In this section, we present the results of the multiple regression analysis. We ran a multiple regression for the pooled sample (both trained and non-trained farmers together) with the yield of linseed in 2010 (productivity) as dependent variable. A test result for multicollinearity ruled out the possibility of interaction between age and years of experience, hence they can both be included in the regression analyses.

Determinants of linseed productivity

Table 5.3 presents the multiple regression output showing the step-by-step models as we add separately the different knowledge bases and their interactions to assess how they influence the dependent variable, linseed productivity.

Table 5.3 Multiple regression results with model options: determinants of linseed yields

	Model 1	Model 2	Model 3	Model 4	Model 5
Variables	B Coef. (SE)	B Coef. (SE)	B Coef. (SE)	B Coef. (SE)	B Coef. (SE)
Age	-0.66 (3.28)	-0.58 (3.35)	-0.73 (3.33)	-1.68 (3.64)	-
Total land size	11.49 (30.94)	11.62 (31.07)	11.22 (30.88)	11.47 (30.94)	-
Gentle slope	195.83 (75.82)**	197.05 (76.72)**	184.30 (76.62)**	187.52 (76.94)**	183.27 (76.10)**
Sales to private traders	186.76 (63.65)**	187.17 (63.96)**	210.48 (65.08)**	209.79 (65.22)**	206.70 (64.06)**
Experience	-	-0.41 (3.31)	-2.30 (3.48)	-2.22 (3.49)	-8.45 (5.80)
Training	-	-	118.25 (70.97)*	124.22 (71.69)*	-
Education	-	-	-	-46.27 (70.73)	-
Experience * Training	-	-	-	-	7.49 (4.26)*
Experience * Education	-	-	-	-	2.09 (3.49)
R ²	0.10	0.10	0.12	0.12	0.12
Adj.R ²	0.08	0.07	0.08	0.08	0.09

Note: ** Significant at the 5 per cent level; * at the 10 per cent level

In all the 5 models, the regression results in Table 5.3 show that a gentle slope and selling to private traders positively and significantly influence linseed productivity. We also find access to training for linseed production having a significant and positive influence on productivity in models 3 and 4. When we complete the model by adding the interaction variables in model 5, our results further suggest that the interaction of experience with training significantly increases linseed productivity.

5.5 Discussion and policy implications

Our analyses have shown important results on how different knowledge bases and the way farmers are integrated into the oilseeds value chain can affect productivity. Our findings also reveal that other non-knowledge factors influence the level of productivity among linseed farmers.

Even while farmers receive GAP-training on agricultural techniques of oilseeds, land preparation, quality management, post-harvest and marketing, low productivity remains amongst the linseed producers as one of the major problems identified by stakeholders. Looking at Table 5.1, linseed yields have consistently decreased over the 4 production years (2007-2010) for the pooled sample, among both trained and non-trained farmers. Nevertheless, when we look at the groups separately (as shown in Appendix B), the productivity of the trained group does not differ significantly from the productivity of non-trained farmers. This can be attributed to the fact there are other underlying factors that may be required to make the training more effective and beneficial to that the farmers received. Furthermore, apart from the knowledge factors, there are also some other non-knowledge factors, such as land slope and marketing channel, which affect productivity. Our analysis further shows that the training was more useful for the farmers with more years of experience. This is demonstrated by the positive and significant interaction term of training and experience. In a study which evaluates and compare findings of different studies, Lockheed et al. (1980) reports a positive effects of the interaction between formal and non-formal education on productivity in some of the 18 studies carried out in Africa, Asia and Latin America, hence a complementary relationships between different knowledge bases. Alene and Manyong (2007) also concluded from their study on cowpea farmers in Northern Nigeria that

schooling and extension contact are essential complementary inputs to research and development efforts aimed at technological change in agriculture which in turn increase productivity.

Farmers cited unfavorable weather conditions as one of the main reasons why productivity is not improving. They further highlighted that linseed generally holds a higher risk of poor performance due to bad weather conditions as compared to other crops such as teff. Hence, breeding of a more tolerant seed type can be of great assistance. Farmers indeed understand that oilseeds are profitable but they are discouraged because of adverse weather conditions. In addition, non-knowledge factors also influence crop productivity: the slope of the land plays an important role in yields. A gentle slope is associated with high productivity in linseed since it retains nutrients and prevents them from leaching or being washed away. Hence, it is important to take such factors into account when assessing the impacts of any knowledge source.

The level of formal education was found to have an insignificant impact on productivity. Our results are similar to the findings by Evenson and Mwabu (2001) that showed the effects of schooling on crop yields for different crops in Kenya to be positive but statistically insignificant. In a similar vein, Battese and Coelli (1995) also reports a non-significant impact of farmers' education on farming efficiency in India. Our finding can be attributed to the environment where the effect of education on productivity is being assessed. For instance, studies by Pudasaini (1983) and Schultz (1975) suggest that education contribute more to productivity in modern agriculture than it does to traditional agriculture which is most common among rural farmers. Weir (1999) points out to a prevalent view that given the traditional character of Ethiopian agriculture, education has no economic value to the country, and the benefits of schooling are primarily non-economic in nature. This may be also the case because there are other important unobserved factors such as managerial abilities which - together with agricultural extension - have a strong influence on crop yields.

Marketing linseed through private traders was the most common channel used by farmers. As shown in the descriptive statistics in Table 5.1, private traders were offering on average a higher price per kilo of linseed as compared to cooperatives. Additionally, the Didaa cooperative union

manager highlighted the shortage of working capital as a major challenge limiting the capacity of the cooperative to buy the whole produce from the members. Another point to note is that the training that was provided mainly focused on the production side and somehow neglecting the marketing side. This is aggravated by the fact the union is a multi-purpose cooperative which also collects several crop products such as teff, wheat, beans and spices. Thus, in such a situation, one important way that the farmers may learn and acquire useful knowledge on marketing activities is through market interactions with buyers. Through repeated transactions between buyers and sellers, the farmers learn more about how the market functions in terms of pricing and quality requirements. This kind of knowledge in turn translates itself into tacit knowledge.

The policy implication that can be drawn from our analysis is that productivity in linseed can be significantly increased by the simultaneous effect of an interaction of several knowledge bases instead of any individual knowledge bases. It therefore suggests that it is important to provide training to the farmers with more experience, so that they can transfer the knowledge on production to other farmers. Furthermore, there is need to breed more resistant seed that can withstand unfavorable weather conditions. The results of our study also provide an economic rationale for policy makers to fund the knowledge bases that contribute more towards higher agricultural productivity and thus reinforce income earnings among rural farmers in Ethiopia. We share the same opinion with the other researchers who argue that the effects of education are more pronounced in modern agriculture. Hence, we suggest that investments should not be spread evenly but focused on the knowledge bases which are more beneficial to the farmers. It is important to take into account the environment in which the farmers are located. In this case the farmers in question are in rural areas hence investing in education may not be productive. Training is more hands-on and practical hence could be more useful to the farmers. Additionally, the researchers need to document information on the effects and importance of tacit knowledge that is currently filling the gap left between formal knowledge sources (training and education) and informal experience-based knowledge.

CHAPTER 6. Discussion and conclusions

6.1 Introduction

Large quantities of agricultural products are produced by smallholder farmers in Ethiopia. However, productivity is generally low due to binding constraints such as lack of inputs, limited access to technical know-how, scarcity of credit and slow technological innovation. This suggests a need to engage in agricultural intensification practices. Sometimes, cooperation can be a helpful device to speed-up this intensification process. In this regard, Poulton et al. (2006) point out that poor information (particularly in agriculture: on prices, on new technologies, and on potential contracting partners) pose particular problems for supply-chain development needed for agricultural intensification. Farmers face numerous challenges that hinder them from reaching out to the lucrative markets and improve their income and livelihoods. Something has to be done to overcome these challenges. The main question we aimed to address in this thesis is therefore defined as follows: Can agricultural intensification be achieved through cooperatives to address these challenges and if so, what are the requirements and what are the implications? We thus seek to understand the role that cooperatives can play to facilitate agricultural intensification among the resource-poor farmers. The field research was conducted in Ethiopia in three different value chains (honey, dairy and linseed) to enable a problem-focused analysis of a number of key constraints related to agricultural intensification. In the previous chapters, we analyzed several avenues through which intensification can be achieved (i.e. improved internal organization, higher input use, technology adoption and better articulated knowledge systems) and the particular shortcomings encountered within the before-mentioned value chains. The current chapter serves to summarize the main findings of the study and to outline their research and policy implications in section 6.2. Hereafter, we proceed in Section 6.3 with the main contributions of the research to scientific discussion where we draw some insights from our study findings and also acknowledge some of the limitations of our research. We finalize in Section 6.4 with the policy implications of our findings and in Section 6.5 we propose some suggestions for further research.

6.2 Results

This section addresses the research questions we posed in the introductory chapter of this thesis. All four research questions revolve around the different dimensions under which cooperatives can undertake or facilitate the intensification process as a way to increase productivity and to enable better livelihoods and higher welfare for smallholder farmers. The main findings of the research are summarized as follows:

6.2.1 Internal organization of farmer cooperatives, collective entrepreneurship and income generation

In Chapter 2 we looked at the structural differences between two different forms of honey farmer groups (cooperatives and PLCs). Honey is a high-value export product with strong potential in the international market. The main aim was to assess how differences in the internal organization of these groups influence collective entrepreneurship and income of producers. Our analysis was based on the literature on collective management of common goods and transaction cost theorem. The results show that PLCs hold a higher level of collective entrepreneurship due to their favorable structural characteristics, such as small group size as well as other features such as higher degree of specialization, member loyalty, a well-structured incentive system and social capital with the buyer. The rate of adoption of the transitional beehives was therefore higher among PLC members. We also found that producer organizations can be more efficient in their operations if they are created for a specific purpose (specialization) rather than if they maintain a broad orientations (diversification). In this case PLCs only specialize in trading honey which makes them efficient, while cooperatives are engaged in trading several commodities. Generally, the manner in which the PLCs are organized makes it easier for them to build trusting relationship with the processor and exporter (Bezamar). It emerges that the processor was paying the PLCs in advance, but only pays the cooperatives after the transaction is realized through in the export market. Unlike in PLCs, there is high external influence (by the government) in cooperatives which negatively affects their performance. We further analyzed why cooperatives are still existent in the area if they are being out-performed by PLCs in every aspect. Our analysis shows that the cooperatives still exist due to a number of reasons. The cooperatives in

the area are multipurpose in the sense that they trade a number of different agricultural commodities such as beans, peas and spices. This means their members will just have to bring their products to one place. In this way they reduce transaction costs associated with searching buyers for their other commodities. Inadequate information amongst the cooperatives members about the performance of other collective enterprises they could join (such as PLCs) also explains why cooperatives are still existent. Finally, the initial investment that is required to set up a new collective group is quite high in the area. Hence, the general conclusion that can be drawn from this study is that PLCs are facilitating intensification through the adoption of improved beehives and are better integrated into the market, which encourages improved production and better income for farmers.

6.2.2 Factors that determine yields and quality performance among smallholder dairy producers

Chapter 3 highlights the results of a study carried out to disentangle the role and importance of different explanatory factors that influence yields and quality performance among smallholder dairy producers in Ethiopia. We followed a similar classification by Zuniga-Arias et al. (2008) to assess the determinants of dairy performance (quality, production and productivity). Key factors include individual/households characteristics, management features, production system characteristics and market attributes. The findings suggest that technical and individual factors such as breed type, feed type, feeding regime, the level of education, cooperative membership and the number of lactating cows are very important factors influencing milk performance. We also find that cooperatives are playing an important role in the development of the dairy sector in the study area, by means of facilitating the adoption of intensified modes of production, such as the crossbreed cows and agro-industrial feed. However, currently such intensification seems to be occurring at the expense of some quality indicators. This implies that the factors of production (e.g. breed, feed type, cooperative membership) that increase milk production and productivity often depress the nutrients density of the milk, such as fat and protein content. What does this trade-off mean for agricultural intensification? It implies that agricultural intensification is mainly satisfying the quantitative element of the production process and neglecting product

quality, which is highly important for obtaining better prices. There is need to engage in interventions that can counteract this trade-off between quality and quantity. As Zuniga-Arias (2007) put it, quality is a composite of biological and managerial practices. Cooperative dairy farmers could therefore benefit from scheduled trainings as a way to improve product quality while at the same time achieving large quantities.

6.2.3 Individual factors that influence cooperative membership and the impacts of cooperative membership on technology adoption and market exchange

In Chapter 4 we identified factors that can influence the farmers' probability of becoming a cooperative member. This is followed by an analysis on the impact of cooperative membership on several outcome measures, including technology adoption and market exchange characteristics. This study was motivated by the fact that the demand for milk and milk derivatives in Ethiopia is increasing due to urbanization, population growth and expected increase in consumers' disposable income. Cooperatives have been identified as possible effective institutions to facilitate dairy development and influence the economic prospects of dairy farmers. Hence, we seek to find out what makes farmers to join or not to join cooperatives and what are the likely welfare and intensifications implications. Our findings reveal that older and educated farmers with larger family sizes are more likely to join cooperatives. Farmers with larger portions of land and who stay further away from the milk collection centers are less likely to join cooperatives. Looking at the impact outcomes, our analysis shows that cooperatives can indeed facilitate the development of dairy sector based on intensification through using improved technologies and resulting in improved producers' income through increased milk production, higher milk productivity, stronger commercialization and more technological innovation. Interestingly enough, however, our findings further reveal no significant influence of cooperatives on the price of milk. The implication of this study is that cooperative dairy farmers are experiencing more an extensive growth process (expanding horizontally) where production and productivity are increasing but they are not getting better in terms of unit milk prices. The price bargaining on the side of the cooperative remains weak and this may affect negatively farmers' incentives for further intensification.

6.2.4 Knowledge systems and the interactions effects on farmers' productivity

The main objective of this exploratory study presented in Chapter 5 is to assess how different knowledge bases and their interactions influence productivity among linseed producers in Ethiopia. In addition, we identified other socio-economic and physical factors that also influence productivity of linseed. Our findings show that linseed productivity and sales to private traders are influenced by biophysical conditions (gentle sloping land) and knowledge provided through training and experience. Productivity among linseed farmers is very low due to numerous factors including lack of appropriate technical know-how. This subject is important because, as highlighted by Belayneh and Alemayehu (1988), labour-intensive management practices are highly critical in linseed (*Linum usitatissimum* L) production since linseed yields are much more affected by weed control and sowing date. Farmers acquire knowledge on how to efficiently cultivate a product through different channels. These include formal education, experience or through training. In addition to these, there is also tacit knowledge which is acquired after an exemplary practice has been put to use over a period of time. There is mixed evidence in the literature on how these different knowledge bases influence productivity among farmers. Our findings suggest that training is more useful and effective for more experienced farmers. It also shows the importance of improving extension services in cooperatives as a way to increase agricultural productivity. Interactions with market agents through engagement in market exchange helps farmers to gain adaptive knowledge. The chapter demonstrates the importance of adaptive knowledge which assists farmers to be flexible and easily adjust their practices whenever there is a change in external circumstances. Such knowledge will enable farmers to respond effectively and efficiently to changes in quality preferences and consumer demands, or even to cope with climatic changes that can affect productivity.

6.3 Contributions to scientific discussion/ theoretical advances

We acknowledge that in some of the surveys we used in this research, we suffer a major challenge of a small “n” which may result in lack of internal validity. Hence, it may cause difficulties in drawing robust conclusions. Nevertheless, the small “n” is precisely the reason why we embarked on a comparative approach in our research. We could rely on different cases

and different commodities and external validity to focus on key constraints that were characteristic to each of the three value chains (honey, dairy and linseed). The strength of our analysis therefore lies in the fact that we focused on particular constraints that influence cooperative performance in each of the sectors. A comparative analysis of these three value chains enabled us to identify a range of options for enhancing agricultural intensification through cooperatives, involving all relevant stakeholders along the value chain and to face the binding constraints that are encountered in the process. This allows us to draw more general conclusions on the element that links the three value chains which is *the cooperative organization*, thus enhancing the external validity of the study. Hence, a number of useful contributions to the literature on agricultural intensification and linking farmers to the markets can be derived.

Our findings demonstrate that cooperatives are capable agents for promoting agricultural intensification. This can be seen from the different strategies that cooperative members are using to increase productivity and involve in technological innovation. However, our findings further reveal that while cooperatives are associated with higher production and productivity, they do not automatically favour quality enhancements. Quality upgrading requires an increased use of improved technologies, whereas cooperative farmers tend to focus on increasing yields and neglecting the value-added components of the production process.

Consequently, cooperative members are experiencing an extensive growth with little improvement in their economic benefits. This means that cooperative farmers are realizing higher productivity by growing horizontally, but they are not receiving always higher prices for their products. The question arise as to what are the implications of these trade-offs on agricultural intensification? One of the major contributions this thesis makes is by identifying possible pathways by which the process of agricultural intensification can be brought to a better balance, i.e. reducing the registered trade-offs in the intensification process.

The study support the idea that agricultural intensification is not a top-down approach but an interactive process where information and knowledge is exchanged between agents involved. All stakeholders along the value chain are important in their own special way and should harmonize

their roles in order to make the process of intensification successful. Hence, it is critical to transform the traditional top-down approach towards a more interactive process. The interaction process can be facilitated by the cooperative which act as an '*interface*' between the farmers and the market. In the three value chains, cooperatives are playing rather different roles to cement the coordination and relationships between farmers and the market. In the honey sector, the producer groups are supplying honey producers with the relevant information from the processor on quality requirements (for example the moisture content) and on the appropriate harvesting time of the honey. Additionally, they established a trustful relationship with the processor which also facilitates access to value chain financing. In the dairy sector, the cooperatives play a mediating role by facilitating the adoption and use of improved technologies by farmers as a way to increase productivity. Moreover, they offer milk quality control services to their members to ensure that the market receives the desired quality and quantities. Lastly, the cooperatives in the linseed value chain organize interactions with external stakeholders that provide tacit technical and market knowledge to the farmers as a measure to device to increase linseed productivity.

We propose a scheme in Figure 6.1 showing the major upstream and downstream linkages of cooperatives in which activities can become better integrated to make intensification attainable.

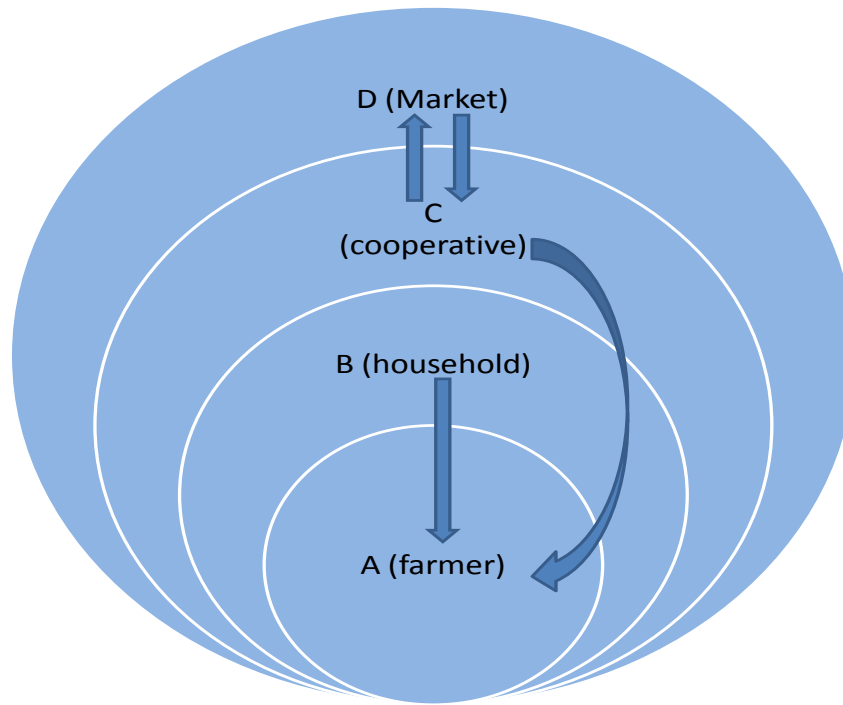


Figure 6.1 Moving towards “balanced growth” intensification

A reconciliation to the before-mentioned trade-offs can be achieved by creating a “balanced growth” in the intensification process, where improved production activities are harmonized with investments in farmer training and market management. Figure 6.1 shows that at point A, a farmer can work towards achieving higher productivity but at the same time he/she needs human resources from the household (B) and some technical support and input provision to enhance quality management from the cooperative (C). With specialized support from the cooperative, a farmer may be able to increase production and/or productivity, but this is usually limited to horizontal growth. Improving marketing performance and receiving higher prices requires that farmers and their organizations are better able to bargain with sellers and processors at point D. These market incentives are necessary to create viable incentives to encourage farmers to invest in improved product quality. This would enable a more balanced growth process. Currently, there are limited quality incentives in place in Ethiopia.

Moreover, apart from access to guaranteed market outlets, farmers also need an assurance of a good price for their product. The cooperative might respond to their weak impact on price

bargaining by engaging in product upgrading, i.e. incorporating and investing in value-adding activities in their operations. Not only will this be helpful for improving net income for farmers, but it also supports the expansion of markets for urban middle classes and export market opportunities. Cooperatives need to strengthen their bargaining position on prices through continuous interaction with the market where they can build long-term business relationships.

A general conclusion that can be drawn from this discussion is that horizontal coordination (at cooperative level) is a necessary but sometimes not sufficient governance structure to achieve a process of balanced intensification that links smallholder farmers to markets and thus improves their welfare. Vertical organization is also needed where we closely integrate the activities of farmers, processors and traders in order to overcome the trade-offs between volume and quality; and between productivity and price. This would be consistent with Zuniga-Arias (2007) who argue that vertical integration and horizontal coordination might simultaneously enhance quality and management practices throughout the chain. Creating a “balanced growth” is critical, otherwise the trade-offs that come with intensification will remain a key challenge. The contributions this thesis has made could guide some future research on the steps and strategies which farmers and their cooperatives could take to achieve success in the progress towards agricultural intensification. We discuss some of these options in Section 6.4.

6.4 Policy implications

Given the need for intensification and the numerous challenges and high transaction costs faced by smallholder farmers in developing countries across the globe, collective action has been noted as a possible way to overcome market failures, achieve economies of scale and benefit from market transactions. However, we have seen from the honey value chain study that being in an organized group is not enough to benefit the members. There are several institutional factors that govern the way in which these groups operate and can influence the success of a collective group. These include group size, property rights (buying shares), incentive system, etc. To overcome the weak market linkages, farmers organized in smaller groups such as private limited companies (PLCs) perform better compared to their cooperative counterparts. It is, therefore, imperative to advocate for smaller groups which are easier to manage, facilitate collective

entrepreneurship and provide a platform for trusting relationships between producers and the processors, as illustrated in the case of the honey value chain. Also, cooperatives should allow members to buy shares as a vehicle to enhance member loyalty. However, these results should not be generalized across all the agricultural sectors in Ethiopia. Further research can be carried out in other sectors in order to find out whether these results generally hold.

Agricultural intensification through cooperatives is likely to help curb the ever growing demand of food through improved productivity, but also needs to contribute to improved income for farmers. Cooperatives provide services such as facilitating access to high-yielding technologies. However, the dairy case studies show that intensification seems to be occurring at the expense of quality performance. Fortunately, this can be overcome by better input (feed and breed) management which can create an improved balance between quantity and quality of produce. Moreover, in-depth investments to improve the housing conditions of crossbreed cows contribute to maximizing their production capacities. Farmers therefore need access to both short-term and long-term finance to address these important constraints.

The overall outcome of the case studies has shown that cooperatives - through facilitating intensification - can positively influence productive performance and commercialization of smallholders. However, the prices they receive are not significantly different from those offered by other agents. Interventions to engage in product upgrading could serve as a way to reduce the power of middlemen and to retain a larger profit share for farmers and their cooperatives. Participation in cooperatives in Ethiopia is still limited, despite the efforts by the government to stimulate membership. Distance from the market and processing centers was among the factors that negatively influence the farmers' decision to become cooperative members. Hence, more could be done by the government to encourage farmers to join and patronize with their cooperatives, establishing (like in dairy) collection centers in areas further away from the main roads to cater for farmers in such areas, reducing barriers to smallholder participation and providing credit facilities. Another important finding is that cooperatives still seem to be excluding the poorest of the poor, hence more need to be done to make cooperatives accommodative to this marginalized group. We expect that the results of our study contribute to

a deeper understanding of the relationship between the incentives required for smallholder farmers to become engaged in cooperative organization and thus foster the process of agricultural intensification.

The findings of our case study on the linseed value chain demonstrate the importance of knowledge exchange and extension services for cooperatives. It shows that linseed productivity can be significantly increased by the simultaneous effect of an interaction of different knowledge bases. Experienced farmers gain more from training; hence it could make sense to engage those experienced farmers in the replication of their results towards other farmers. In this way knowledge can be effectively and rapidly disseminated amongst farmers. It is also important to identify what type of knowledge works best for the farmers so that training efforts and resources are channeled towards more effective sources of knowledge that can facilitate agricultural intensification and improve incomes to farmers. As well, the environments (modern or traditional agriculture) in which the farmers are operating also need to be taken into consideration. We further realized that there is an important source of tacit knowledge that is often overlooked in the literature. Many public extension services focuses on the production side and tend to neglect the marketing side. Our analysis suggest that farmers learn about production and marketing issues (price information, quality requirements and sales timing) from the engagement with buyers and private traders. Such tacit knowledge complements formal training and experience in the agricultural intensification process.

6.5 Further research

Collective action has a potential to benefit its members as well the global development process. As stated earlier on, there are several structural characteristics and institutional features that govern farmer groups and influence its success or failure. However, we acknowledge that our findings cannot be generalized across regions and sectors in Ethiopia due to small sample size and differences in geographic characteristics. Moreover, the nature of key bottlenecks that each sector faces also influences the type of organization that can serve the needs of farmers. It is important, therefore, that more studies are carried out in different agricultural sectors where

different kinds of producer organizations are operating. This could be helpful to determine whether alternative institutions to cooperatives should be encouraged in different sectors.

Also the type of market outlets is likely to influence prospects for collective action. Product quality is a relative issue which cannot be generalized for all the consumers across the world. It has different meanings to different people. Some consumers may prefer, for instance, low fat content for drinking milk while others may prefer high fat content for the same purpose. This has not been empirically analyzed in the Ethiopian context. Hence, it is important to carry out studies which assess different opportunities for linking producers with several kinds of consumers in order to respond adequately to their demand preferences.

It is beneficial for small individual farmers to pool their resources and thus improve their bargaining power. Cooperatives provide different services ranging from input provision, bulking, transportation and commercialization. However, given a situation where cooperatives offer, on average, the same price as other buyers, one still wonders what makes farmers stay loyal to their cooperatives. Apparently, in addition to monetary benefits also non-monetary issues matter. It will be of critical importance to understand the full welfare potential of cooperatives in a situation of missing markets, state dominance and imperfect information.

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Appendices (to Chapter 5)

Appendix A: Chow test analysis

We employed a Chow test, an econometric model, in order to determine whether the same regression model is appropriate to explain the relationship between the dependent variables and explanatory variables between two groups. Basically, by using this model we aim to find out if the regression model explaining trained farmers' linseed productivity is different from the regression model explaining non-trained farmers' productivity.

Hence the hypotheses are stated as follows:

H_0 : Regression model = same (no structural change)

H_1 : Regression model \neq same (there is a structural change)

The model can be presented as follows:

$$F = \frac{(a - b)/P}{b/(n - 2p)}$$

Where:

$$a = \text{RSS}_P$$

$$b = \text{RSS}_T + \text{RSS}_{NT}$$

$$n = \text{df}_p + 1$$

P = number of parameters (slope and intercept)

RSS = Residual Sum of Squares

$$F = \frac{(19220177,24 - 17984681,60)/9}{17984681,60/(147 - 2(9))}$$

$$F = \frac{137277,293}{139416,136}$$

Therefore: $F = 0,9847$

The critical value of $F(9, 129)$ at $\alpha = 5\%$ is 1,953

The critical value of $F(9, 129)$ at $\alpha = 1\%$ is 2.548

Conclusion: Since our F-test is smaller than the critical values both at the 1% and 5% significance level, we accept the null hypothesis that there is no structural change. This means that the regression line is the same for both the trained and non-trained group. Hence, we have strong evidence to reject the alternative hypothesis that there is no structural change.

Appendix B: Productivity difference between trained and non-trained

Yield/hectare: Trained vs. non-trained

Variable	Trained			Non-trained			t	p-value
	N	Mean	SE	N	Mean	SE		
Yield/ha	98	365.35	43.33	49	285.05	40.45	1.355	0.178

Summary

Engaging Cooperative Farmers in Agricultural Intensification: Case Studies on Honey, Dairy and Linseed Value Chains in Ethiopia

The expected increases in population and global food prices present both economic opportunities and challenges to rural smallholder producers. Farmers face multiple constraints that limit their productivity, such as scarcity of inputs, limited access to technical know-how, lack of credit and slow technological innovation. Therefore, to address the increasing demands for agricultural commodities, farmers have to shift from an extensive way of production to intensification. However, this move may not be easily accomplished at individual level and requires the presence of some degree of cooperation. However, agrarian cooperatives are not without their own problems which may seriously hinder their contributions towards intensification and farmer development.

The discussion on the importance of cooperatives or producer organizations in assisting smallholders in the production and marketing of their products; and their impact on poverty reduction has been frequently discussed in the development literature. Given the high transaction costs that individual farmers face in accessing markets (either for buying inputs or marketing their produce), it makes economic sense for farmers to pool their resources as a way to improve their bargaining position. Collective action could make a positive contribution to the process of agricultural intensification.

In this thesis, we analyze how cooperative farmers in Ethiopia engage into processes of agricultural intensification and value chain integration, and we discuss the main drivers and the likely outcomes of this process. We tackled our discussion from a comparative point of view, focusing on key bottlenecks related to agricultural intensification in three different sectors (honey, dairy and linseed), in order to understand how cooperatives can be useful devices for facilitating the process of agricultural intensification and increasing market orientation. To investigate this central issue, we addressed the following research questions: (1) How does the

internal organization of farmer cooperatives affect collective entrepreneurship and income generation? (2) What are the factors that determine yields and quality performance among smallholder? (3) What are the individual factors that influence cooperative membership among farmers and what are the impacts of cooperative membership on technology adoption and market exchange? and (4) How do knowledge systems and their interactions affect farmers' productivity and the way they are integrated into the market?

To achieve our objectives, we used different household survey data sets collected from different regions and agricultural sectors (honey, dairy and linseeds) in rural Ethiopia. Chapter 2 looks at the internal organization of different types of farmer groups (cooperatives and private limited companies-PLCs) to understand how their institutional and structural differences influence collective entrepreneurship among beekeepers. Our findings suggest that - compared to cooperatives - PLCs hold a higher level of collective entrepreneurship due to their favourable structural characteristics, such as small group size as well as other features such as the higher degree of specialization, member loyalty, a well-structured incentive system and the available social capital with the buyer. Hence, as evidenced from the experience with PLCs, internal organization of farmer groups is a crucial factor in facilitating intensification through the adoption of improved beehives and the engagement in better market integration, which encourages improved production and ultimately leads to higher income for the farmers.

Chapter 3 looks at the determinants of economic performance amongst dairy smallholders, paying special attention to the trade-offs between productivity and quality. The findings of this study suggests that technical and individual factors such as breed type, feed type, feeding regime, the level of education, and the number of lactating cows are very important factors influencing milk performance. The findings further provide evidence that cooperatives could be effective institutions for the development of the dairy sector in the study area, by means of facilitating the adoption of intensified modes of production, such as the crossbreed cows and agro-industrial feed. However, this intensification seems to be satisfying mainly the productivity side while neglecting product quality, hence a trade-off between productivity and quality still constrains further development.

In Chapter 4, we assess the impact of cooperative membership on household welfare. We find that cooperatives can indeed facilitate the development of dairy sector based on intensification through using improved technologies and resulting in improved producers' income through increased milk production, higher milk productivity, stronger commercialization and more technological innovation. However, we did not find any significant influence of cooperatives on the price of milk. This implies that cooperatives are facilitating an extensive growth path (i.e. expanding horizontally) for their members where productivity and production are increasing while the price per unit is not improving. An important conclusion arising from this study is that the non-significant effect of membership on milk price has a negative effect on farmers' incentive to make necessary investments and to engage in further intensification.

Chapter 5 presents an exploratory study where we look at how different knowledge systems and their interactions affect productivity among linseed farmers. We identified several other socio-economic and physical factors that also influence linseed productivity. Linseed productivity can be significantly increased by the simultaneous effect of an interaction of different knowledge bases. Experienced farmers gain more from training; hence it could make sense to engage those experienced farmers in the replication of their results towards other farmers. Our findings also demonstrate the importance of improving extension services in cooperatives as a way to increase agricultural productivity. Furthermore, there is also tacit knowledge which is acquired after an exemplary practice has been put to use over a period of time. This form of knowledge arises as a result of interactions of farmers with market agents through engagement in market exchange which in turn help the farmers to gain adaptive knowledge.

The current thesis makes a number of contributions to scientific discussion. Despite the challenge of a small “n” in some cases, we can highlight some of these important contributions as follows:

- 1) The thesis embarks on a comparative case study approach that allowed us to focus on particular bottlenecks that influence cooperative performance and the prospects for intensification in each of the three sectors (honey, dairy and linseed).

2) Our study demonstrates that cooperative members are experiencing an extensive growth pattern (mostly reaching higher production and sometimes also better productivity) while they are hardly experiencing any improvements in terms of product prices. We therefore identified possible pathways through which the process of agricultural intensification can be brought to a better balance, particularly for reducing the registered trade-offs (e.g. higher commercialization versus low prices) in the intensification process.

3) The current thesis proposes a model/scheme showing major upstream and downstream linkages of cooperatives in which activities can become better integrated in order to make intensification more attainable, thus bringing a reconciliation into the registered trade-offs (between volume and quality; and between productivity and price) and thereby creating the conditions for a more balanced process of economic growth and development.

As far as policy implications are concerned, there are a number of common issues arising from the analysis of the three value chains we have studied in the thesis. Even though our findings may not be generalized across all sectors and in different countries, they do provide policymakers with useful pathways that could possibly enhance the intensification process to the benefit of smallholder farmers and the rural community at large. First, in the case of honey value chain we see that smaller groups tend to overcome weak market linkages and their members are receiving better income as compared to their counterparts in larger groups. Hence, it becomes necessary to advocate for adequate group size. Second, the dairy value chain provides some clear lessons how trade-offs (for example between productivity and quality) may limit the process of intensification. Nevertheless, with proper training on (feed) management that can be easily organized and implemented through cooperatives, an optimal balance between quantity and quality of produce could be reached. Third, to improve the prices received by the cooperative members, it becomes imperative for cooperatives to engage in product upgrading in order to reduce the power of middlemen and to be able to retain a larger profit share for their members. Additionally, there are a number of transaction costs that discourage farmers to become cooperative members. One example we noted from our findings is the distance to the milk collection centers. To counteract this problem, the government might establish more collection

centers in such marginalized areas, thus reducing some barriers to smallholder participation. Fourth, the linseed value chain demonstrates the importance of knowledge exchange and extension services for cooperative intensification. It highlights the importance of the market environment (whether traditional or modern) in which farmers are operating. From this perspective it could be efficient to fund or invest in the knowledge bases that are more beneficial to the farmers rather than spreading out resources. The case further highlights the importance of tacit knowledge as an important complement to the formal knowledge bases.

Overall, the thesis shows that even though cooperatives have their own constraints like any other type of business, they are a suitable model for promoting the rural intensification process and for improving market integration of smallholder farmers. They may thus provide a win-win situation where farmers' incomes and livelihoods improve, consumers' demands and product quality specifications are met; and prospects for rural development can simultaneously be realized.

Samenvatting (Summary in Dutch)

Het betrekken van coöperatieve boeren bij de intensivering van landbouw: Studies over honing-, zuivel- en lijnzaad-waardeketens in Ethiopië

De verwachte bevolkingsgroei en de stijging van wereldvoedselprijzen bieden zowel kansen als uitdagingen voor kleinschalige landbouwproducenten. Deze boeren ervaren een veelheid aan beperkingen die hun productiviteit begrenzen, zoals schaarste van grondstoffen, beperkte toegang tot technische kennis, gebrek aan krediet en langzame technologische innovatie. Om het hoofd te kunnen bieden aan de groeiende vraag naar landbouwproducten, moeten boeren de omschakeling maken van extensieve- naar intensieve productie. Deze omschakeling is niet eenvoudig op het niveau van de individuele boer en vereist een zekere mate van samenwerking. Landbouwcoöperaties worden echter gekenmerkt door hun eigen problemen die een belangrijke belemmering kunnen vormen voor de vereiste intensivering en verdere ontwikkeling van de boeren.

Het belang van coöperaties of producentenorganisaties voor het ondersteunen van kleine boeren bij het produceren en vermarkten van hun producten en hun effect op armoedebestrijding wordt veelvuldig besproken in de ontwikkelingsliteratuur. Gezien de hoge transactiekosten waar individuele boeren mee geconfronteerd worden wanneer ze toegang tot de markt trachten te krijgen (zowel voor het aankopen van grondstoffen als voor het vermarkten van hun eigen producten) is het vanuit een economische oogpunt zinvol voor boeren om hun middelen samen te brengen als een manier om hun onderhandelingspositie te versterken. Collectieve actie zou derhalve een positieve bijdrage kunnen leveren aan het proces van landbouwintensivering.

In deze thesis analyseren we hoe leden van landbouwcoöperaties in Ethiopië betrokken zijn in het proces van landbouwintensivering en waardeketenintegratie. We bespreken de belangrijkste stimuli en de te verwachten uitkomsten van dit proces. Deze analyse is tot stand gekomen door de centrale knelpunten met betrekking tot landbouwintensivering in drie verschillende sectoren (honing, zuivel en lijnzaad) met elkaar te vergelijken. Dit alles met als beoogde doel om inzicht

krijgen in hoe coöperaties van waarde kunnen zijn bij het faciliteren van het proces van landbouwintensivering en toegenomen marktgerichtheid.

De volgende vragen staan in het onderzoek centraal: (1) Hoe beïnvloedt de interne organisatie van boerencoöperaties het gezamenlijk ondernemerschap en de mogelijkheden voor inkomensgeneratie?; (2) Welke factoren bepalen de opbrengsten en de kwaliteit van kleine boerenproductie?; (3) Welke individuele factoren beïnvloeden het lidmaatschap van coöperaties en wat is de impact van dit lidmaatschap op de adoptie van nieuwe technieken en de mate van marktintegratie? en (4) Hoe beïnvloeden kennissystemen en hun onderlinge interactie de productiviteit van boeren en de wijze waarop boeren in de markt zijn geïntegreerd?

Om onze vragen te beantwoorden, hebben we gebruik gemaakt van een aantal datasets van boeren(gezins)bedrijven, verzameld in verschillende regio's op het platteland van Ethiopië en binnen drie uiteenlopende productiesectoren (honing, zuivel en lijnzaad). Hoofdstuk 2 bestudeert de interne organisatie van verschillende type boerengroepen (coöperaties en particuliere commanditaire vennootschap) om op die manier te begrijpen hoe institutionele en structurele verschillen het gemeenschappelijk ondernemerschap van bijenhouders beïnvloedt. Onze bevindingen suggereren dat de commanditaire vennootschap – vergeleken met coöperaties – gekenmerkt worden door een hoger niveau van gemeenschappelijk ondernemerschap door gunstige structurele kenmerken, zoals kleine groepsgrootte, hoge mate van specialisatie, loyaliteit van de leden, een goed gestructureerd beloningssysteem en het aanwezige sociale relatie met de koper. De interne organisatie van boerengroepen is dus, zoals bewezen door de vergelijking met de PCVs, een cruciale factor in het faciliteren van de intensivering door het in gebruik nemen van verbeterde bijenkorven en de betrokkenheid in betere marktintegratie. Dit bevordert een verbeterde productie wat dan uiteindelijk ook weer resulteert in betere inkomens voor de boeren.

Hoofdstuk 3 kijkt naar de factoren die de economische prestaties van kleine melkveehouders beïnvloeden. Dit hoofdstuk besteedt in het bijzonder aandacht aan de spanning tussen productiviteit en kwaliteit. De bevindingen van deze deelstudie laten zien dat technische en

individuele factoren zoals ras type, voedselsoort, voedingsregime, het opleidingsniveau (van de boeren) en het aantal melkkoeien erg belangrijk zijn om de melkproductie beïnvloeden. De bevindingen bieden daarnaast bewijs voor het idee dat coöperaties effectieve instituten kunnen zijn voor het ontwikkelen van de zuivelsector in het studiegebied door het faciliteren van het gebruik van geïntensiverde productiemethoden, zoals veredelde koeien en agro-industrieel veevoer. De intensivering lijkt vooral ten goede te komen aan de verhoging van de productie, en verwaarloosd de kwaliteit van de producten. Er is dus sprake van een spanning tussen productiviteit en kwaliteit die de verdere ontwikkeling kan belemmeren.

In hoofdstuk 4 bestuderen we de impact van coöperatie lidmaatschap op de welvaart van het huishouden. We concluderen dat coöperaties, zoals verwacht, de ontwikkeling van een geïntensiverde zuivelsector faciliteren door het gebruik van verbeterde technologieën, hetgeen dan weer kan resulteren in betere inkomsten van producenten door verhoogde melkproductie, hogere melkproductiviteit, sterkere commercialisering en meer technologische innovatie. Desondanks vinden we geen significante invloed van coöperaties op de prijs van melk. Dit betekent dat coöperaties vooral de extensieve groei (c.q. horizontale uitbreiding) voor hun leden faciliteren: de productiviteit en de productie stijgen. Maar de prijs per eenheid melk verbetert echter niet of nauwelijks. Een belangrijke conclusie die voortkomt uit deze studie is dat het niet-significante effect van lidmaatschap op de prijs van melk een negatief effect heeft op de prikkel van boeren om noodzakelijke investeringen te doen om te komen tot een verdere intensivering.

Hoofdstuk 5 presenteert de resultaten van een exploratief onderzoek waarin we laten zien hoe verschillende kennissystemen en hun interactie de productiviteit onder lijnzaadboeren kunnen beïnvloeden. We hebben verschillende andere sociaaleconomische en fysieke factoren geïdentificeerd die productiviteit van lijnzaad beïnvloeden. Lijnzaadproductiviteit kan significant worden verhoogd door in te zetten op simultane effecten (wisselwerking tussen) verschillende soorten kennis. Ervaren boeren halen meer voordeel uit training, daarom zou het nuttig kunnen zijn om hen meer te betrekken bij het repliceren van hun resultaten naar andere boeren toe. Onze bevindingen laten ook zien dat het belangrijk is om de dienstverlening van coöperaties te verbeteren teneinde de landbouwproductiviteit te verhogen. Verder laten onze resultaten zien dat

wanneer voorbeeldpraktijken langere tijd in gebruik zijn, deze resulteren in 'tacit' (ervarings)kennis. Deze vorm van kennis is vooral het resultaat van de interactie van de boer met marktagenten door hun betrokkenheid in markttuitwisseling. Dit helpt de boer op zijn beurt in het opdoen van toepasbare kennis.

Dit proefschrift draagt op een aantal manieren bij aan de wetenschappelijke discussie. Ondanks de uitdaging van een beperkt aantal respondenten in enkele veldstudies, kunnen we het belang van deze bijdrage als volgt formuleren:

1) Deze studie vertrekt vanuit een vergelijkend perspectief van enkele veldstudies, hetgeen ons in staat stelt om goed inzicht te verkrijgen in systematische knelpunten die de prestaties van coöperaties en de vooruitzichten voor intensivering in elk van de drie sectoren (honing, zuivel en lijnzaad) beïnvloeden.

2) Onze studie toont aan dat leden van coöperaties een uitgebreid groeipatroon doormaken (vaak een hogere productie bereiken en soms een betere productiviteit) terwijl ze nog nauwelijks enige verbetering in termen van de productprijs ervaren. Wij hebben daarom enkele opties geïdentificeerd waardoor het proces van landbouwintensivering beter in balans kan worden gebracht, in het bijzonder om de aangetoonde spanningen in het intensiveringsproces te reduceren (bv. hogere commercialisering versus lage prijzen).

3) De thesis presenteert een model dat de voorwaartse en achterwaartse ketenrelaties van coöperaties laat zien waarbinnen activiteiten beter geïntegreerd kunnen worden. Dit is van belang om intensivering beter bereikbaar te maken, waardoor er ook meer evenwicht tot stand gebracht kan worden op het terrein van de aangetoonde spanningen (tussen volume en kwaliteit; en tussen productiviteit en prijs). Op deze manier worden de randvoorwaarden gecreëerd voor een meer gebalanceerd proces van economische groei en ontwikkeling.

Wanneer het gaat om beleidsimplicaties komen er een aantal gemeenschappelijke zaken uit de analyse van de bestudeerde waardeketens naar voren. Hoewel onze bevindingen niet veralgemeniseerd kunnen worden voor alle sectoren en verschillende landen, bieden ze

beleidsmakers wel handvatten die mogelijk het proces van intensivering kunnen bevorderen ten bate van de kleine boeren en de landbouwgemeenschap in haar geheel.

In de eerste plaats zien we in de casus van de honingwaardeketen dat kleine groepen beter bestand lijken te zijn tegen zwakke marktverbanden en dat hun leden betere inkomens ontvangen in vergelijking tot leden opererend in grotere groepen. Het is daarom noodzakelijk om te pleiten voor een adequate groeps grootte. In de tweede plaats laat de zuivelwaardeketen duidelijk zien hoe spanningen het proces van intensivering kunnen beperken (vb. de tegenstelling tussen productiviteit en kwaliteit). Met adequate training op het gebied van voedingsmanagement, die gemakkelijk georganiseerd en geïmplementeerd kan worden door coöperaties, kan echter een optimale balans tussen kwantiteit en kwaliteit van productie bereikt worden. In de derde plaats, om de prijzen die coöperatieleden ontvangen te verbeteren is het essentieel voor coöperaties dat ze zich bezig houden met het opwaarderen van een product, ten einde de macht van tussenpersonen te verkleinen en om een grotere winst voor hun leden te verkrijgen. Bovendien zijn er een aantal transactiekosten die boeren ontmoedigen om lid te worden van een coöperatie. Eén voorbeeld uit onze bevindingen is de afstand tot melkverzamelcentra. Om dit probleem te overwinnen zou de overheid meer verzamelcentra in gemarginaliseerde gebieden kunnen realiseren waardoor verschillende barrières voor de participatie van kleine boeren verkleind worden. In de vierde plaats, laat de lijnzaadwaardeketen het belang zien van kennisuitwisseling en technische dienstverlening (extension') voor de intensivering op coöperatief niveau. Dit wijst op mogelijkheden in de (traditionele dan wel moderne) marktomgeving waarbinnen boeren opereren. Redenerend vanuit dit perspectief zou het efficiënter kunnen zijn om te investeren in kennisontwikkeling, die - nog meer dan het voorzien van (hulp)bronnen - direct ten goede komt aan de boeren. De casus laat verder het belang zien van de ervaringskennis als een belangrijke aanvulling op de formele kennisbasis.

Concluderend laat dit proefschrift zien dat - hoewel coöperaties hun eigen beperkingen kennen zoals elk ander bedrijfstype - zij een geschikt model kunnen bieden voor het bevorderen van het proces van landbouwintensivering en voor het verbeteren van de marktintegratie van kleine boeren. Coöperaties zouden dus een win-win situatie kunnen creëren waarin tegelijkertijd het

inkomen van boeren en hun leefomstandigheden verbeterd worden; alsdat voldaan wordt aan de behoeften van de consument en aan hun verwachtingen met betrekking tot de kwaliteit van producten, en waarin reële vooruitzichten voor rurale ontwikkeling gerealiseerd kunnen worden.

About the author

Clarietta Chagwiza was born in Gutu, Zimbabwe. She studied at the University of Fort Hare, South Africa, where she received both her Bachelor and Master degrees in Agricultural Economics. Her Master thesis was on the economics of biofuels. In 2009, she enrolled as a PhD candidate at the Centre for International Development Issues in Nijmegen (CIDIN), a department at Radboud University Nijmegen. Her research was conducted within the framework of the Netherlands Organization for Scientific Research (NWO-WOTRO) funded programme on “Cooperatives and (Value) Chains” that was coordinated by CIDIN at Radboud University Nijmegen in close cooperation with Wageningen University and Erasmus University Rotterdam. Her research interests include but not limited to cooperatives, value chain analysis, agricultural technology adoption, sustainable agricultural development, market linkages, poverty reduction, quality and trade issues; and rural development. Currently she is staying in South Africa with her hubby and daughter Shamiso.